JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE

State of Pennsylvania,

DEVOTED TO THE

MECHANIC ARTS, MANUFACTURES, GENERAL SCIENCE,

AND THE RECORDING OF

AMERICAN AND OTHER PATENTED INVENTIONS.

MAY, 1835.

FOR THE JOURNAL OF THE FRANKLIN INSTITUTE.

Notice of the Sandy and Beaver and the Mahoning Canal.

(WITH A MAP.)

Two companies have been chartered by the Legislatures of Ohio and Pennsylvania, to construct canals to connect the western termination of Pennsylvania with the Ohio and Erie canal. A charter for the Mahoning, or northern route, was first obtained; subsequently, a charter for the southern, or Sandy and Beaver, route, was granted.

The Sandy and Beaver route commences at the mouth of the Big Beaver, twenty-eight miles below Pittsburg, and continues down the north flats of the Ohio river, to Little Beaver creek; thence it occupies the valley of that stream, till it reaches the town of New Lisbon; a short distance north of which, it ascends, by a narrow ravine, to the dividing ridge between the waters of the Beaver and Sandy; after crossing which, it continues along the valley of the Sandy, and gradually descends to its mouth, near which it intersects with the Ohio and Erie canal, at Bolivar.

The route is ninety miles in extent, and is located through an extremely rich and fertile country; the summit occupies the dividing ridge between New Lisbon, and a point west of the town of Hanover, a distance of fourteen miles; it receives the drainage of eighty square miles of country, and is to be supplied with water from Cold Run, Brush Run, and west fork of Little Beaver Creek, Sandy Creek,

Holland's Creek, Mendenhall's Run, and Davis' Branch; in addition to which, the head waters of the Mahoning can be conducted into it by means of a short feeder. These streams, at their minimum, afford sufficient water for the transit of seventeen boats per day, and, during nine months of the year, an average flow of 2,570 cubic feet of water per minute; an amount adequate to accommodate a trade of 295 boats per day: in addition to this, it is proposed to erect reservoirs, from time to time, as the business may require. Many eligible sites for this purpose are to be found contiguous to the line, four of which have been surveyed, and found to have capacity to contain 280,000,000 cubic feet of water, and would inundate 726 acres of land.

The work is to be constructed of the same dimensions as the Pennsylvania and Ohio canals; the locks, aqueducts, and bridge abutments, are to be formed of sand stone, and are intended to be of the most permanent character; the country through which the route is located, affords materials for the construction of the work, such as stone, timber, and hydraulic lime, of the best description, and in the greatest abundance; the cost of the whole work, including reservoirs, is estimated at $1,289,000.

The Governor of Ohio, in his last annual message, mentions the Sandy and Beaver canal in the following favourable manner: "Viewing a communication between the Pennsylvania and Ohio canals to be a subject of great interest, it is with peculiar satisfaction I communicate to you the intelligence, that the Sandy and Beaver canal company was organized during the last summer, under the liberal provision of the original charter, and the munificent grant of the legislature, in an amendatory act of the last session." "By the report of two able and experienced engineers, all doubts have been removed from the public mind, as to the supply of water on the summit, and is conclusive as to the question of an abundant supply of water for all the demands of an extensive commerce." "Such a connexion has long been a desideratum to the people of the interior and southern parts of Ohio, as it will open to them a new and short route to the eastern markets for their abundant produce, and will enable the eastern and western merchants to transport goods from the east at a much earlier period of the spring, than by the New York canal."

The Mahoning, or northern route, commences at the village of Akron, on the Ohio and Erie canal, and from thence extends, in an easterly direction, to the Little Cuyahoga, at Middlebury; "from which it pursues a north-easterly course, until it approaches near the main Cuyahoga, in the township of Stow; thence continuing the same general direction along the south and south-east bank of that river, until it passes the village of Franklin, it enters the valley of the Breakneck creek, and passing up that valley in an easterly course, it crosses the summit between the waters of the Cuyahoga and Mahoning branch of the Big Beaver, near the village of Ravenna. The line then descends rapidly into the valley of the west branch of the Mahoning, crosses that stream near its south-westerly bend, continues along its north bank, recrossing that branch, and also the

south, or main branch, a mile above the junction of those streams; then leaving the river, the line pursues an easterly course, again approaching the river opposite the village of Warren," and then continues along the valley of the river, in a south-easterly direction, to the Big Beaver; thence it follows the valley of the Big Beaver, and connects with the Ohio at the town of Beaver. The whole distance from Akron to the Ohio, by this route, is about one hundred and twelve miles.

The canal commissioners of the state of Ohio, in their report on this route, propose to supply the summit level with water by the following means.

1st. By a feeder from Breakneck creek. This stream, they state, may be introduced by a feeder three miles and six chains in length, and is sufficient for the supply of the summit level, and the contiguous levels, in ordinary seasons, during more than half the year. In the dryest seasons, when the flow of water is reduced to the least quantity, it yields about 240 cubic feet per minute.

2d. By forming reservoirs of four lakes, or ponds, situated near the summit. These bodies of water, Muddy Pond, Sandy Pond, Brady's Lake, and Lake Pippin, may, they state, be converted into valuable and convenient reservoirs, for the supply of the summit, and the adjacent levels; the two former will contain an area of about 240 acres. Water to the depth of twenty feet, or even more, may be accumulated in these ponds, and conducted into the canal, by means of a feeder, seventy-eight chains in length. A depth of eight or ten feet of water on the area of Brady's Lake, and Lake Pippin, may be made available to supply the canal in dry seasons.

It is computed that 325,000,000 cubic feet of water may be reserved for use in these reservoirs.

It will be perceived by the foregoing description—deduced from the reports of Major Douglass, Col. Kearney, E. H. Gill, H. Hage, and Col. Dodge, the engineers that examined the routes—that the summit of each canal has to rely on reservoirs, during a period of drought, for a supply of water. By an examination of their respective charters, it will be found that the stockholders of the northern, or Mahoning route, are permitted to receive but ten per cent. on the cost of the work in tolls, while the Sandy and Beaver canal company are allowed twenty; in addition to which, it has received from the Legislature of Ohio, the following very liberal grant, which alone, in a very few years, will much more than repay the cost of the work.

"That when the canal authorised to be constructed by the act, entitled an act to incorporate the Sandy and Beaver canal company, shall have been completed twenty miles from the Ohio canal, said company shall be entitled to collect and receive the tolls accruing on the Ohio canal, on all freight and passengers that may be transported thereon, and which have been transported not less than twenty miles on said Sandy and Beaver canal, to the Ohio canal; and to receive the toll on all freight and passengers that may be transported thereon, and discharged and landed in said Sandy and Beaver canal, at any point not less than twenty miles from the Ohio canal, for the

term of seven years from and after the completion of the twenty miles of canal aforesaid."

Viewing the two routes in point of accommodation to the trade of the west and south-west, embracing the states of Kentucky, Indiana, Illinois, Missouri, and the most fertile portion of Ohio, it will be observed that, by the Sandy and Beaver route, the distance to Pittsburg, or Philadelphia, is *sixty-five miles less* than by the Mahoning, or northern route.

The western termination of the Sandy and Beaver canal is in 40° 36′, north latitude; Pittsburg, 40° 28′; and Philadelphia, in 39° 57′. Hence, it will be perceived that the three places are nearly in a direct line. These facts portray, in the strongest light, the merits and advantages possessed by this route over any other, and that it is the most direct and desirable continuation of the Pennsylvania canal. From the western termination of the Sandy and Beaver canal, at Bolivar, the distance by the Ohio canal, Lake Erie, the New York canal, and Hudson river, to the city of New York, is 780 miles; and by the Sandy and Beaver route, and Pennsylvania improvements, to Philadelphia, 511; making a difference between these two communications to the sea-board, of 269 miles. In addition to this very decided advantage in distance in favour of the Pennsylvania and Ohio communication, is to be added, safety, economy, and despatch, and the long periods in spring and autumn which it could be used, when the lake route would be obstructed by ice, or hazardous, as is often the case, by storms.

The immense commerce that the Sandy and Beaver connexion will secure to our market, cannot at present be approached, even by conjecture. If we view the vast extent of rapidly improving country, where cities and towns are springing up as if by magic, two-thirds of the rich products of which must seek our market through this channel, some distant idea may be formed of the benefits our present chain of internal improvements, and the city of Philadelphia, are destined to derive from this communication.

As both the northern and southern route have to receive a supply of water, during a dry period, from reservoirs, the following statement may prove interesting.

Philadelphia, Dec. 29th, 1834.

Sir,—In conformity with your request, I hand you the following statement, descriptive of the merits of the summit of the Sandy and Beaver canal, compared with the Licking summit of the Ohio canal; the latter, you will perceive from the annexed letter from the present acting canal commissioner of the state of Ohio, Leander Ransom, Esq., the general accuracy of which I can vouch for, from my own personal observation, has thus far been, in a measure, entirely supplied with water by a reservoir; this reservoir covers an extent of about 2,400 acres, and, when full, has a depth of six feet above the plane of the water in the canal, and is said to contain 570,000,000 cubic feet of water; it is located on a stream which, during ordinary seasons, affords a flow of fifty cubic

feet per minute, but which, during the latter part of the last summer, was entirely dry. The reservoir receives the drainage of from thirty to forty square miles of country, and, during all portions of the year, it alone has to supply near thirty miles of the summit, and dependent levels, with water, and, during the dry season, about forty-four miles. At the period of my visit to the reservoir, which was during the dryest part of the past season, there was a flow from it into the canal of 1,329 cubic feet per minute, which, at that time, was the only supply received by the summit, and its then dependent levels. The average number of boats then passing, was eight per day; to convey which across the summit, required at least an expense of twelve locks full of water per day, equal to 112 cubic feet per minute; if to this sum is added one hundred cubic feet per minute, for leakage at the locks, (which were in a very bad condition,) there will be left for evaporation and filtration on the forty-four miles supplied from the reservoir, 1,117 cubic feet per minute, or twenty-five cubic feet per mile.

This, though I shall, in the following calculations, assume it as datum, is by far too liberal an allowance, because, from measurements and observation, made by me at the time, I found that the upper level, which is nine miles in extent, and through ground of a similar character, to the summit of the Sandy and Beaver canal, but 117 feet per minute were lost by evaporation and filtration, or thirteen cubic feet per mile per minute.

The minimum natural flow of water into the summit of the Sandy and Beaver canal, during the dryest period of the year, and measured during the past extremely dry season, is 558 cubic feet per minute, (though for nine months of the year it will average 2,570 cubic feet per minute;) the extent of line dependent on this supply is twenty miles, but seven of which, from the peculiarly favourable formation of the soil, and its wet and springy nature, can possibly require any allowance for leakage and evaporation. If, on this seven miles, an allowance for leakage and evaporation of twenty-five cubic feet per mile per minute is made, amounting in the aggregate to 175 feet per minute, there will still be left 383 cubic feet per minute for leakage at the locks, and the purposes of navigation; sufficient to accommodate a trade of thirty-eight boats per day, (the locks having a lift of six feet,) during the dry season, without any aid whatever from reservoirs.

No section of country is, perhaps, more favourably formed, in point of soil and topography, for the construction of numerous and large reservoirs, than that through which the summit of your proposed work is located; during my recent examinations there, sites for four were examined, having capacity to contain 280,649,600 cubic feet of water, and would receive, from actual survey, the drainage of forty-eight square miles of country. Assuming that seventy per cent. of the annual rain that falls, can be collected into reservoirs, which admits of no doubt, being within the limits of the result of actual experiment, and that thirty-six inches in depth of rain falls annually in your latitude, and the above described section of country

will afford the reservoirs a supply of 2,810,141,720 cubic feet per annum; in addition to which, the summit drains fifty-two square miles of country, fifty per cent. of which could, if required, be laid up in other reservoirs, making, in the aggregate, 4,985,164,800 cubic feet of water, upon which no demand need be made but in the dry season, or ninety days in the year.

In drawing a comparison between the Licking summit of the Ohio canal, and that of your proposed canal, it will be observed the former has an extent of forty-four miles, which is entirely dependent on the reservoir for water during the dry season; that the natural flow of water into that reservoir is but fifty cubic feet per minute, the drainage about thirty-five square miles, and the maximum depth of the reservoir is but six feet; while the latter has an extent of but twenty miles, to meet the demands of which there is a natural flow, at the driest periods of the year, of 550 cubic feet per minute; in addition to which, numerous reservoirs may be formed as required, varying from ten to thirty feet in depth, and having a surface of eighty square miles, to supply them with water.

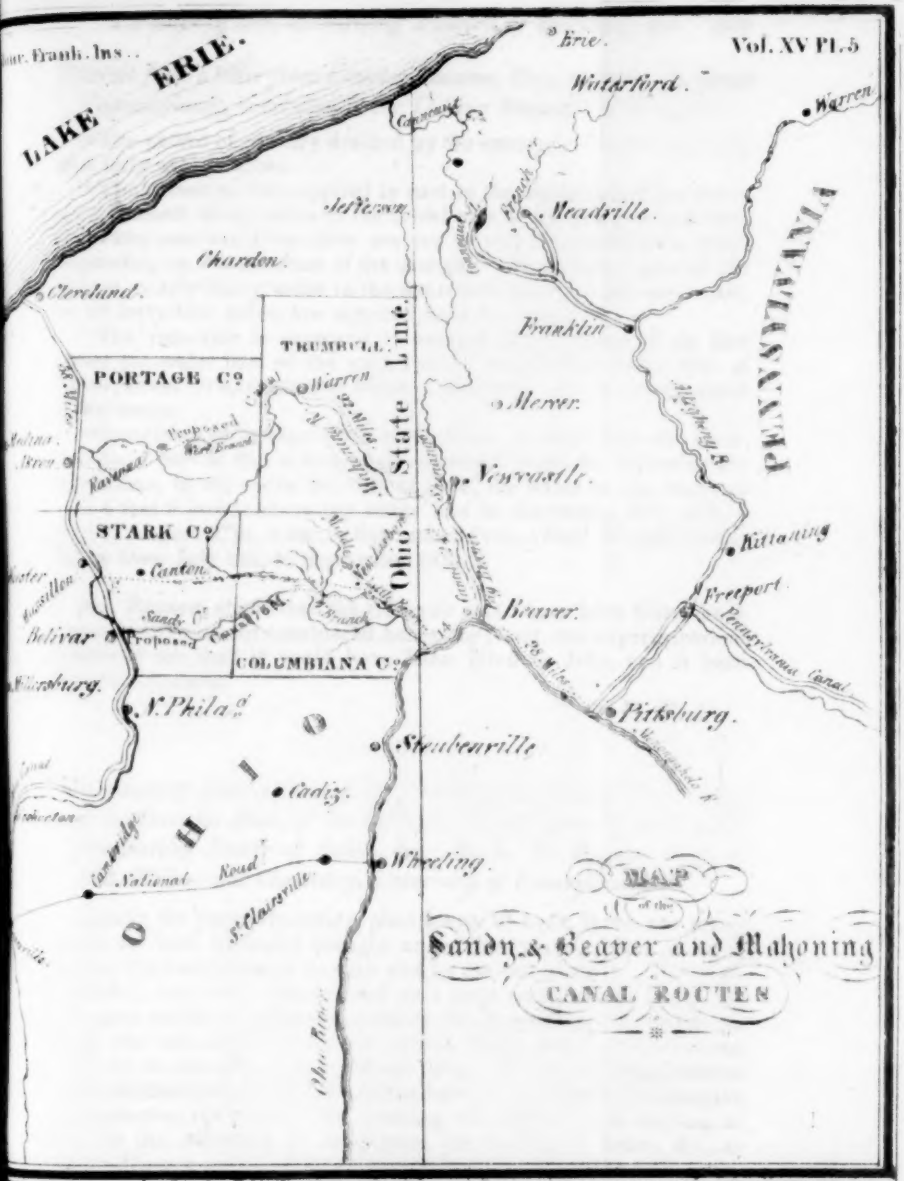
The very favourable result afforded by the Licking reservoir, may be fully anticipated from the proposed works of a similar character on the summit of the Sandy and Beaver canal; the soil and country are alike, and their proximity to each other renders each alike subject to the effect of the same changes of climate. I cannot think any other evidence than a comparison requisite to satisfy an unbiassed mind, that the supply of water that can be obtained on your proposed canal route, is far more than adequate to meet the demands that may be made on it.

But other evidence, if requisite, can be adduced in favour of the firm reliance that can be placed in reservoirs; if we look to France, there we find the Languedoc canal, supplied in a great measure from a reservoir; if we refer to England, we find the Rochdale, the Huddersfield, the Nottingham, the Oakham, the Oxford, the Dudley, the Stourbridge, and the Grand Trunk canals, the summits of most of which are entirely supplied with water by reservoirs. In Scotland, they have been found of immense advantage. In our own country, we have, in addition to the Licking and Portage summits of the Ohio canal, which are supplied by reservoirs, the summit of the Chesapeake and Delaware canal, which is, of itself, a large reservoir, and receives but a small portion of constant running water, and the summit of the Union canal. The Schuylkill Navigation Company has, during the late dry season, received great assistance from the reservoir lately erected at the head of their works.

Very respectfully, yours,

E. H. Gill,
Civil Engineer.

B. W. Bakewell, Esq.,
One of the Directors of the Sandy and Beaver Canal.



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Extract from a letter from Leander Ransom, Esq., Acting Ohio Canal Commissioner, in relation to the Licking Summit and Reservoir.

"The extent of country drained by the reservoir, is between thirty and forty square miles.

"The extent of line supplied in part to the westward of the reservoir, is about thirty miles in the driest part of the season; however, the water received from other sources is very inconsiderable, much depending on the duration of the drought. In the driest part of the season, nearly thirty miles to the westward, and fourteen north-east, in all forty-four miles, are supplied from the reservoir.

"The reservoir is supposed to contain, when filled to six feet above top water line of the canal, about 870,000,000 cubic feet of water, about 570,000,000 of which is available, and to cover about 2,400 acres.

"Something of an idea of the expenditure of water from the reservoir for a part of this season, may be formed from the following observations, to wit:—On the 25th of June, the water in the reservoir was 4 feet 5 inches above top water line in the canal; July 13th, 4 feet 9; August 27th, 3 feet 9; September 24th, 3 feet. No rain having fallen from July 4th, to September 24th."

Mr. Ransom states that the reservoir could have been filled much more, but it was not considered necessary; and the superintendent informed me that it could have been filled in July, had it been deemed requisite.

E. H. G.

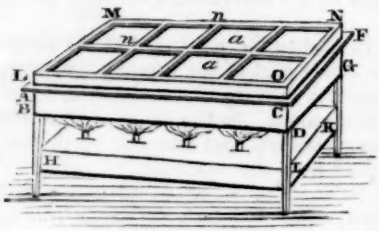
Experimental Illustrations of the Radiating and Absorbing Powers of Surfaces for Heat, of the Effects of Transparent Screens, of the Conducting Power of Solids, &c. By A. D. Bache, *Prof. of Nat. Philos. and Chemistry, University of Pennsylvania.*

Among the very interesting phenomena of heat, there are many which are with difficulty brought under the eyes of a class, so as to render them satisfactory to each one, by the test of sight. The thermometer, even when constructed on a large scale, affords but an inadequate means of rendering evident the temperature of bodies, to those who are distant from the lecture table, and the illustrations made by its use are, at best, rather tame. When the temperatures to be indicated admit of it, lecturers have, in preference to using the thermometer, resorted to the freezing of water, to the melting of wax, to the inflaming of phosphorus, the boiling of water, &c., as more adequate means of rendering evident the temperatures in question.

The instruments about to be described, I have found very convenient for class illustration, and always to afford satisfactory evidence of the positions to be proved. The first instrument is intended to

show the powers of different surfaces in radiating and absorbing heat, with other phenomena, which will be referred to in the sequel.

Fig. 1.



To produce a sensibly uniform temperature, a prismatic vessel, A B C D F G, fig. 1, of sheet iron, of a convenient size, is filled with melted tin, and covered at top by a plate of sheet iron, A F, or, in preference, by a plate of cast iron, of moderate thickness. The temperature of the tin is kept up by an alcohol lamp, H I K, with several wicks, fitting below the box, and between the legs which support it; by this means, the top radiates heat of considerable intensity. I prefer the use of tin, in the box, to that of oil, on account of the greater cleanliness resulting from its use, and because the oil gives off an offensive smell at high temperatures. Boiling water does not give a sufficiently high temperature to produce rapid action in the apparatus, and the greater exactness with which it would yield a constant temperature, is not necessary in such an illustration.

A rectangular frame, L M N O, made of dry wood, to prevent its warping, of a small height, L A, and of a length and breadth such as to adapt it to its place upon the cover of the box, A G, is divided by cross pieces of wood into small squares, or rectangular compartments, as *n n*, the upper surface of the frame being perfectly plain, and parallel to the cover, A F, of the box containing the melted tin; this frame is intended to support, without the necessity of contact with each other, small plates of thin metal, or other appropriate material, the surfaces of which are variously coated.

To show the *radiating powers of different surfaces*, any convenient number of thin plates of sheet lead, or sheet tin, or mica, are cut to suit the size of the squares, *n n*, of the frame, overlapping the inner edges, but not extending to the middle of the small dividing bars of wood; each one of the plates has one of its surfaces differently coated; supposing them to be of lead, one is coated with lamp-black, another brightened by sand paper, or coated with tin leaf, another left tarnished, a fourth coated with gold leaf. Being placed upon the frame, as at *a*, *a*, with the coated sides uppermost, small bits of phosphorus are placed upon the middle of the plates, and the frame put in its place upon the cover, A F. The surfaces which absorb the heat radiated by the cover, A F, being the same, the material and thickness of the plates being the same, the circumstances are alike in each plate, except so far as the upper surface is concerned; the plate which is coated with the worst radiator, will become warm first, and the phosphorus will melt first upon it, and, generally, the order of melting of the phosphorus will indicate the inverse order of the radiating powers of the surfaces. As the heat radiated from the cover is high, the melting of the phosphorus will be soon followed by

its inflaming, and the order thus given will hardly deviate from the first; the interference from the film of oxide, which is so annoying in the modification of the apparatus of Ingenhousz, for illustrating the relative conducting powers of bodies, is almost entirely obviated by the high temperature of the source of heat. To avoid injuring the coated surfaces, a thin film of mica may be placed below the phosphorus, the film being large enough to prevent the effect of the spreading of the phosphorus, as it burns.

The plates should be made thin, in order that the results may be mainly dependent upon differences in the radiating power of the surfaces. I have used plates of thin sheet tin, (iron coated with tin,) of sheet zinc, and of glass, with good effect. The effects may be accelerated by coating the under surfaces with lamp black, to promote the absorption of heat; but in that case, care should be taken that the thickness is at least equal to that which produces the greatest amount of absorption.

Instead of the pieces of phosphorus, wax, or other readily fusible material, may be used, as in the apparatus of Ingenhousz; or cones of wood, weighted at the base, and kept upon the plate, with the vertex downward, by a fusible material, may be substituted.

It may happen that the lecture table is so arranged as to render it advantageous to incline the cover, A F, of the box, A G; this will be readily accomplished by making the cover part of the box itself, in which case the melted metal may be introduced through a hole in the higher side; as, for example, in A D.

To illustrate the fact that *absorption and radiation are proportional*, the same square plates, *a a*, &c., may be used; the variously coated surfaces are placed downwards, phosphorus is put, as before, on the upper surfaces, and the frame deposited in its place upon the cover of the box. The phosphorus will now melt in the inverse of the order shown in the first experiment, the plate having the best absorbent surface, heating first. If plates of metal be used, their upper surfaces should be bright, for this illustration; but glass, or mica, which will allow the coating to be seen through, is best adapted to the purpose.

The fact that the *radiation*, or *absorption*, of heat *does not take place merely at the surface*, but at a definite thickness, which becomes very appreciable in good radiators, may be satisfactorily shown by coating the surface of one of the plates with a thin layer of lamp black, and another one with a considerable thickness of the same material. If the coatings be upwards, as in the first illustration, the phosphorus will melt soonest upon the thinly coated plate; if the coatings be downwards, as in the second illustration, the reverse will be the case.

The *effect of transparent screens* in preventing the passage through them of heat not accompanied by light, may be shown by using, in the same instrument, plates of glass, mica, &c., of equal thickness; theoretically, the differential results are not as free from objections as the former ones; but the fact is illustrated almost unexceptionably, since the phosphorus melts first at the surface of the plate, which it

would not do if the plate were cool, and the fusion resulted from the absorption, by the phosphorus, of the heat which had passed through the screen of glass, or mica.

These illustrations I have tried repeatedly, and successfully; there are others of a more refined character, which I have not yet had an opportunity to attempt, but which, I doubt not, might be carried out very easily. The first of these is the curious property discovered in rock salt, by M. Melloni, of permitting the passage of heat of low intensity, as freely as that of high; a piece of phosphorus placed upon the salt, and another upon a thin film of mica, the under surface of which should be coated with lamp black, just above the plate of rock salt, would serve to show this property. That transparent plates of mica are only partially diathermous, would be shown in a similar way, and, in fact, by the relative periods of fusion of the phosphorus just above the plate, and of that upon it, a notion of the relative quantities of heat stopped and transmitted, might be furnished.

Another illustration which I have tried with success, is that of the want of specific effect of colour on the absorption of non-luminous heat; a fact which some researches, undertaken by Professor Courtenay and me, and not yet published, indicate. On coating the plates on one side with lamp black, plumbago, white lead, chalk, prussian blue, vermillion, &c., it will be found that the phosphorus melts upon them without regard to the order of colour. Care should be taken that the thickness of the coatings is such as to give to them each the maximum radiating or absorbing power; a thickness which will differ for each material, but which may, for all, be very easily exceeded.

By a change in the character of the plates, this instrument may be used to advantage in showing the experiment devised by Franklin, and executed first by Ingenhousz, for indicating the relative *conducting powers of solids* for heat.

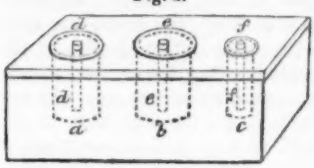
That the experiment just referred to does not truly give the relative conducting powers of bodies, can, I think, be clearly demonstrated, notwithstanding that it is found, in all the books, in juxtaposition with the very elegant and accurate method proposed by Fourier; with the explanation of its intrinsic defects, it may be, however, still admitted as a general illustration. To apply the instrument, plates of the same thickness of the substances to be tested, as, for example, of tin, iron, lead, copper, pottery, wood, glass, &c., which can be easily obtained in the requisite form, are to be coated on both sides with a thick coating of lamp black, or other good absorbent and radiator, leaving a small strip of the upper surface bare, to exhibit the nature of the material; the plates having phosphorus placed, on mica, upon them, are put upon the frame, and this is placed on the cover of the box: the order in which the phosphorus fires, gives the same indication as in the apparatus of Ingenhousz. This effect is more rapid than when cones, or rods, are used, especially from the lower temperature of the substance which is commonly used as a source of heat. These remarks do not apply, of course, to the forms of that apparatus in which hot sand is used.

The second instrument to be described, is intended to show the

common illustration of the fact that bodies have *different specific heats.*

Theoretically, this illustration is, I think, inaccurate, but is *admissible*, like the last; upon this subject, I hope to be able, at a future time, to be more explicit; at present, my remarks are confined to general illustrations. That different bodies require unequal quantities of heat to raise their temperatures through the same number of degrees, is illustrated upon equal weights, or bulks, by subjecting them, when at the same temperatures, to the same source of heat, and proving that they require different times to arrive at the same temperature. This idea is a fundamental one, and cannot too early be inculcated upon a learner. As an illustration, I have three vessels of sheet iron, to contain equal *weights* of mercury, alcohol, and water; these are fastened to a frame, by which they can be dipped into the same vessel containing hot water. An alcohol thermometer, with a column of fluid large enough to be visible at a moderate distance, dips into each vessel. As the heat enters, the thermometer in the mercury rises with great rapidity, that in the alcohol more slowly, and that in the water lags behind both the others. Instead of those thermometers, if a cylinder of any metal which is a good conductor, and has a low specific heat, such as copper, for example, should, after being coated with a varnish of thickened linseed oil to protect the surface, be introduced into each vessel, phosphorus placed on the top, would melt and inflame first on the metal which dipped into the liquid having the least capacity for heat. In the annexed cut, fig. 2, *a*, *b*, and *c*, are the vessels; *d*, *e*, *f*, metallic cylinders resting in wooden, or metallic, or mica, disks, and the whole dipping into a vessel, *m n*, of boiling water. The mercury is so small in bulk, that the influence of this strikes the student immediately; but the idea which he thus catches at, is refuted by the more tardy heating of the water, which is less in bulk than the alcohol.

Fig. 2.



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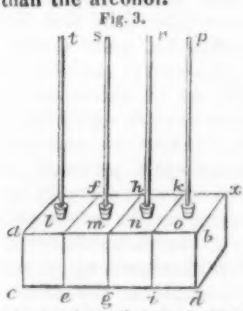
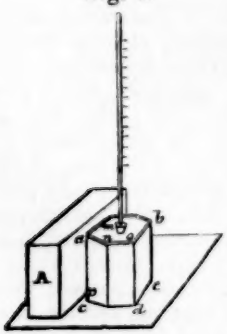


Before the forms of illustration, of the radiation and absorption of heat, already described, had suggested themselves, I had contrived another apparatus, which gave very good results, and may be, by some, preferred to the one already described. A long box, *a b c d x*, of tin, was divided into compartments by partitions, *e f*, *g h*, *i k*, &c., and a top soldered upon each, having a conical opening, *l*, *m*, *n*, &c., to receive a cork, through which a tube, *o p*, *n r*, *m s*, *l t*, &c., passed; these compartments were made as nearly equal as possible, and the tubes entering them were selected of as nearly equal bore as possible;

equal measures of coloured water were poured through the conical openings into the several compartments, so as to cover the bottom to a depth regulated as will be presently stated. The tubes and corks were now inserted, and cemented; and each cell thus formed an air thermometer, the expansion of the air within driving the coloured liquid up the tube entering the cell. That there might be no error from a want of equality in these thermometers, after bringing the liquid to a convenient height in each of the stems, by forcing air into each, or by dropping liquid from a dropping tube into the tube, the whole was plunged into a vessel of water, of a temperature sufficiently above the original temperature of the air within, to give distances on the tubes, readily divisible into equal parts of sufficient magnitude. These degrees were marked by a rude scale, formed by coloured threads, tied around the tubes. One surface of the box was kept uniformly bright, or regularly tarnished, or coated; the other, *a d*, was coated with substances of different radiating powers.

The box being placed with the uncoated side towards a vessel of warm water, the heat enters uniformly that side of the compartments, but is radiated differently from the opposite side, and the liquid from the air thermometers is urged more rapidly up those tubes which enter into the compartments radiating worst, and ultimately arrives at a greater height, showing a greater stationary temperature, or temperature of equilibrium, between the heat absorbed, and that which is radiated. If the vessel be now turned, so that the variously coated surfaces are towards the source of heat, the liquid in those coated with the best absorbents, will immediately begin to rise in the tubes, and that in those coated with the worst absorbents, to fall. That the two lateral compartments are exposed to a greater cooling action than the others, may be an objection to this apparatus; but it is easily obviated, and with it the communication of heat from one compartment to another, by terminating the box at each end by a small compartment, and separating each of the other compartments by a similar space; in fact, convenience alone was the reason for uniting these air thermometers in one vessel.

Fig. 4.



Another form of apparatus, which is more simple, I have found convenient; but it occupies more time than that last described, in obtaining the same results. A prism of any convenient number of sides, is made into an air thermometer, in the manner described in speaking of the last apparatus; the sides are variously coated; it fits loosely into a prism of the same form, but wanting one side; in the figure, *a b c e*, represents the enveloping surface, and *m n o p*, the air thermometer. To show the different absorbing powers of the different substances, the vessels described are placed as in the figure, before another, A, containing hot water, hot sand, or any other convenient source of

heat. Suppose the side of the air thermometer which is the worst absorbent of heat, to be exposed to the source of heat, the air within is expanded, and the position of the liquid in the tube is marked by an index; a better absorbent is exposed, and the liquid rises higher; a worse, and it falls below its original level: the experiment can thus be varied at pleasure. The outer sheath, or covering prism, serves to render the surface, not exposed to the source of heat, uniform in its radiating powers, and to protect those sides which are not intended to be exposed to the source of heat, from the radiation of the vessel, A, which, otherwise, would affect them sensibly. If the air thermometer were a rectangular prism, of course the objection just stated would not apply; but the sheath would still be necessary to equalize the radiation from the surfaces not exposed to the source of heat.

To show the radiating powers of the different surfaces, the sheath is turned so that the open side is exposed to the air; the absorption of heat now becomes sensibly constant, and the greater or less height of the liquid in the tube, is determined by the less or greater radiating power of the exposed surface.

The order in which the surfaces are exposed may, of course, be so arranged as not to require the temperature of the source of heat to be kept constant.

Such an apparatus, placed before a stove, would make an admirable illustration in a school, or a vessel of water, colder or warmer than the room, may be used as the radiating or absorbing body. For the tin vessel here described, a common square glass bottle may be substituted, without disadvantage. Even a common glass phial, made into an air thermometer by inserting a tube through a tight cork, into some liquid occupying the lower part of the phial, and provided with a movable coating of tin foil, gilt paper, writing paper, and paper covered with lamp black, when placed before a fire, or in a room of which the air is warm, when the external air is cold, brought near a window, will afford an interesting and instructive illustration.

Philadelphia, February, 1835.

FRANKLIN INSTITUTE.

Monthly Conversation Meeting.

The fifth conversation meeting of the Institute, for the season, was held at their Hall, Feb. 26th, 1835.

Mr. Thos. Fletcher presented an apparatus which was found in the building at the rear of his premises, immediately after it had been discovered to be on fire. This contrivance was of a most ingenious character, and seemed almost certain to produce the effect intended by its nefarious projectors.

Messrs. Carr & Lunt presented specimens of screw augers, manufactured by David Bassett, of Derby, Connecticut; handsome, well

executed tools. Scarcely a meeting passes without furnishing additional evidence that the time is not far distant, when the ingenuity and industry of our mechanics will render their country independent of foreign aid in almost every species of manufacture.

Mr. Stephen C. Ustick exhibited and explained a machine for cutting straw, patented by himself.

Messrs. A. & G. Ralston presented two models of improved chairs for edge railways, one invented by Mr. Stephenson, engineer, of England, and the other by Major D. B. Douglass. Messrs. Ralston also presented the model of a railway, the invention of Mr. Merrick, of this city, which has received the approbation of several distinguished engineers, and has been recommended, by Mr. Strickland, to the Delaware and Susquehanna Rail-road Company. The rail is in the form of a truck, or trough, inverted; the lower edges flanged outwards, to receive the nails, or clamps. It is believed that this form, or a modification of it, will sustain a greater weight, with a minimum quantity of metal, than any of the edge rails, while it is better adapted to resist a lateral thrust, and may be secured to the blocks without chairs.

Mr. John M'Mullen, of Huntingdon, Penn., exhibited a machine for knitting stockings, which performed all its functions with admirable precision, and appeared to be well adapted to give employment to those whose infirmities prevent a recourse to more laborious occupations.

Mr. Charles Wetherill exhibited a snow owl, prepared by Mr. Brano, of Philadelphia.

Mr. Thomas Ellicott, of Philadelphia, exhibited a platform weighing machine, of his own manufacture, in the perfection of which he has attained a well merited celebrity.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Thomas Ewbank's improved Process for Tinning Lead Pipes.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination, specimens of Lead Pipe, coated with tin, made by Thomas Ewbank, of the city of New York, REPORT:—

That they have examined the specimens of tinned lead pipe submitted to them, and are fully satisfied that the coating of the lead with the tin is complete; and from a description of the process, accompanying the specimens, the committee are induced to believe that, when the pipes are of a limited length, it cannot fail, if proper care be taken by the person who conducts the operation.

The superiority of this method over any former plan known to the committee, is the facility with which the pipes are tinned, merely by drawing them through a bath of fluid metal.

The committee would, therefore, recommend to the Board of Managers, the award of the Scott's legacy premium and medal to Mr. Ewbank, for his important improvement in the process of tinning lead pipes, whereby the cost is but little enhanced, which brings them within the reach of all who may have occasion to make use of the article.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

March 12th, 1835.

Report on Seth Graham's Method of Extracting the Hair from Fur Skins.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred, by Mr. S. G. Ladd, of Kennebec, Maine, for examination, a machine invented by Mr. Seth Graham, of the same place, for extracting the hair from fur skins, REPORT:—

That its construction is as follows:

A suitable wooden frame supports two fluted iron rollers, about eighteen inches long, placed parallel to each other, and about three or four inches apart, on a horizontal line; each of these rollers is paired with another similar roller, supported beneath it upon a movable frame, so that it may be detached from its fellow, for the purpose of inserting the skin.

One pair of these rollers, which we may call No. 1, by way of distinction, is made to revolve by means of an endless screw, so as to draw the skin slowly through the machine; the other pair is intended merely to keep the skin stretched, by friction. A smooth iron cylinder, of equal length with the rollers, and situated midway between them, is supported upon a movable frame, so that it may be raised or lowered at pleasure. Immediately over this cylinder is placed the pulling knife, which is a flat bar of steel, about eighteen inches long, one and a half inches wide, and half an inch, or more, thick in the middle, but beviled at the edges; this knife revolves upon pivots at its ends, and is furnished with a pulley at one end, and a fly wheel at the other, to communicate and equalize its revolution. An iron cylinder, covered with leather, and called the elastic cylinder, revolves in boxes fixed upon strong springs, which press it firmly against the pulling knife, to which it is parallel.

The skin from which the hair is to be extracted, is inserted between, and firmly grasped by, the fluted rollers; the movable cylinder is then raised, so as to elevate the skin toward the pulling knife. When this has been so adjusted as to bring the knife in contact with the long hairs, but not with the fur, the machine is set in motion; and as the skin is drawn through by the fluted rollers, No. 1, the long hairs are firmly seized between the edges of the pulling knife and the elastic cylinder, and extracted from the skin; a cylindrical brush, revolving above the elastic cylinder, clears it from the loose hairs.

Several skins were passed through the machine, in the presence of a sub-committee, and they noticed with much satisfaction, that the operation of extracting the hair was performed with great celerity, and, when the skins were smooth, and even haired, as perfectly as could be done by hand.

Where there were defects in the skins, the work was imperfectly executed, and, in all cases, a portion at both ends of the skin was left unpulled. These deficiencies form important objections to the machine, as the expense of completing the work would be nearly equal to the cost of unhairing the whole skin. But the committee deem it no more than justice to state as their opinion, that the machine is susceptible of modifications which will, in a great measure, obviate these difficulties. When thus improved, they believe that it will be an important auxiliary to hatters and furriers.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

March 12th, 1835.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN OCTOBER, 1834.

With Remarks and Exemplifications, by the Editor.

1. For an improvement in *Railway Cars, or Carriages;* Ross Winans, Civil Engineer, city of Baltimore, October 1.

The specification will hereafter be published.

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2. For an improvement in the *Suction Pump;* Elijah Whiton, Groton, Middlesex county, Massachusetts, October 2.

The patentee states that he has made the following improvements:

"1st. The barrels of a pump made of steatite, or soap stone.

"2d. A new and useful method of uniting the barrels of pumps, whether of stone or metal.

"3d. A new and useful method of constructing the lower box.

"4th. A new and useful method of draining the water from pumps."

A patent was some time since obtained for making a pump chamber of marble, and if that was a good claim, the present one, for the use of soap stone, may be so also; but, if so, we think it must be on the ground of its being a "new manufacture," and not as an improvement in the pump.

The account given in the second and third of the above items, does not present any thing worthy of particular notice. The fourth is for a contrivance by which it is intended to open both the valves, and thus to allow the water to descend, and prevent its freezing. There is to be a sort of spring catch on the upper surface of the valve of the lower box, which, when the pump handle is raised to the greatest possible height, hooks on to a ring, or other suitable appendage, on the lower end of the piston, whilst, at the same time, a projecting pin

opens the valve in the piston, or bucket, and the water necessarily descends into the well, or reservoir.

Other contrivances have been made to accomplish this last mentioned end; the patentee, however, has a right to his own plan, if it be new, as we believe it is. There is no claim made, and the object of the patent must, therefore, be inferred from the four points enumerated as constituting the improvements.

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3. For a *Revolving Washing Machine;* John D. Gwinn, Washington county, Tennessee, October 3.

A square box, to contain the clothes, is to revolve on gudgeons, one of them being furnished with a crank, by which to turn it; the other gudgeon is hollow, and extends into an open box, or trough, into which soap-suds may be poured, in order to supply the revolving box, without the necessity of opening the door at which the clothes are introduced; we presume that the dependence for the validity of this patent, is placed upon the hollow gudgeon, and open trough, although this is not very clearly expressed; the advantage of the falling of the clothes in the square box, a thing by no means new, is also insisted on.

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4. For a *Straw Cutter;* Stephen Ustick, city of Philadelphia, October 4.

There is, we think, considerable novelty in certain parts of this machine, but it has the fault of too much complexity. The straw is to be contained in a trough, in the usual way, and is to be fed by fluted rollers of cast-iron. The knife stands horizontally, or nearly so, across a frame to which it is firmly attached. The lower edge of this frame rests upon ways, which form an inclined plane, and, consequently, as the frame slides, the knife descends with a drawing motion. To cause the frame to slide backwards and forwards, there is a pitman, worked by a crank, on the shaft of a fly wheel in front of the machine.

The claim is to "the arrangement of the bottom of the trough; the opposing edge; the feed rollers; the position of the knife; the direction of the knife frame collectively; and the position of the machine, as above described."

Although there is enough in this machine upon which to found a claim, the foregoing appears to us defective in claiming individual parts which are not new, instead of depending, almost exclusively, upon the arrangement and connexion of those parts, in which its novelty principally consists. The feeding rollers, as such, are not new; nor is an opposing edge, to resist the cut of the knife. We have carefully looked over the specification, but are far from having a clear idea of what is included in "the arrangement of the bottom of the trough;" if this part contains any thing peculiar, it is not explained.

5. For an improvement in *Schutes or Sluices in Dams, for the descent of Arks, &c.;* Amos Addis, Washington, Lycoming county, Pennsylvania, October 4.

The claim made in the specification of this patent, is to "every mode of extension of the schute into the pool of the dams; as all extensions above the breast of the dam is my improvement on the present schute, with the inclined plane at the bottom of the schute."

We are unable to understand the, so called, description of this improvement, and cannot, therefore, attempt to epitomize it. This being the case, we dismiss it by giving the claim alone.

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6. For a *Horse Power;* William G. Johnston, Bridgetown, Cumberland county, New Jersey, October 4.

An inclined movable floor is formed with slats of timber, connected by endless chains, which pass over cylinders at each end of the machine, friction wheels being used to sustain it; all these parts are combined together in a manner differing so little from what has been frequently done, that it would be a difficult, and at the same time a useless, task to point out the novelty of the contrivance; the patentee has not attempted it, but claims "the combination and arrangement of the several parts of the machine, and the mode of applying the gearing by which the motion is obtained and communicated."

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7. For a *Machine to produce Alternate Motion;* Benjamin Elliot, Danby, Tompkins county, New York, October 4.

The alternate motion to be produced by this machine, is said to be applicable to churns, and to the propelling of other machinery; the apparatus described is one of those unmechanical contrivances, in examining which a person who has no, or but little, acquaintance with the subject, may readily become bewildered, and imagine that, by the time the action of the first mover is transmitted through the long train of levers, wheels, and pinions, some wonderful effect must be produced.

A weight is to be wound up, and the shaft upon which it is wound is to operate upon a sort of pendulum, which in its turn, through the intermedium of wheels, pinions, levers, &c., is to afford great assistance to the dairy-maid, who, however, will soon be willing to dispense with its services.

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8. For an improvement in machinery for *Making Twisted Roving;* Peleg Arnold, Killingly, Windham county, Connecticut, October 6.

The claim made is to "the following parts, put together in the following manner, for making twisted roving, and laying it upon the bobbin. The top part of the flyer is a cylindrical box, which is attached to its arms. This box has a tube, or pipe, passing down the centre, through which the roving descends; the top part of this tube forms the nose, or top bearing, of the flyer. In the box is a heart and gear, connected together by a pipe, or barrel, having a circular

horizontal motion round the tube through which the roving descends; this passes down through the centre of the gear, barrel, and heart. The heart has a circular horizontal motion between two prongs of a tube, which gives the tube a vibrating motion that distributes the roving on the bobbin; this tube is hung on pivots at the top, where the prongs are connected; the bearings of the pivots are attached to the box, which turns with the flyer. The regulating circular motion of the heart, and the vibrating motion of the tube, are taken from a circular perpendicular motion of a bobbin, which has a circular horizontal one at the same time," &c.

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9. For improvements in *Saw Mills;* Othniel Stone, Pittsford, Monroe county, New York, October 6.

A saw is to be so made as to form a band, or hoop, of any convenient diameter and width; this band is to be passed, like a strap, over two circular drums, one above the other, and the sawing is to be effected by the straight part between the drums; these latter are to have projecting rims, to bear against the back of the saw. To prevent the saw from trembling, it is to pass between friction rollers, stationed just below and above the timber to be sawed.

"The specific new and useful improvements hereinbefore described, and claimed by me as the inventor, are the following.

"First. The shape of the saw. Second. The manner of hanging the saw. Third. The manner of keeping the saw steady, when in motion, by means of rollers. Fourth. The manner of making the saw with teeth on one or both edges."

We have, on more than one occasion, had to refer to the article SAWING, in Rees' Cyclopedia, in which this saw is mentioned as having been patented in England, long ago; how frequently it has sought the same sanction with us, we shall not stop to inquire; but we know that it was patented in 1817, by Adam Stewart, of Baltimore, Maryland; the practical difficulties, however, attending its construction and use, soon convinced its reinventors that it was best to abandon it.

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10. For an improved *Gas Metre;* James Bogardus, city of New York, October 7.

(See description.)

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11. For an improvement in the *Gun Lock;* J. B. Gray, Fredericksburg, Spottsylvania county, Virginia, October 7.

The claim made in this specification is to "the arrangement of the rod, and of the spring, and the adjustment of the notch to the spring placed beneath it." We are not told in what particular this lock is supposed to excel those in use, nor are we able to discover it. The description given is very far from clear, but the drawing which accompanies it is well executed.

12. For a machine for *Cutting Laths:* William W. Lesuer, Urbana, Champaign county, Ohio, October 8.

The laths made by this machine are to be cut from boards, of a thickness proper for the width of a lath, and of a suitable length. A strong, horizontal bench, is prepared, and upon this is placed a frame, which carries a knife as long as the intended lath. The sliding frame to which the knife is attached, receives its motion from a crank and pitman. The carriage is hinged to one side of the frame by two straps of iron, working like the connecting pieces of the common parallel ruler; the board is placed on its edge in a proper mortise, and as the crank moves the pitman, the knife is brought up against the board by a circular, sweeping motion, separating the lath, and allowing it to fall through the mortise. There are mentioned in the description, many parts to which we have not alluded, as they are mere accessories, such as any competent workman could supply. The only thing that we deem new in this machine, is the manner of hinging the knife, by means of jointed straps; in other respects, it does not differ essentially from that patented by D. Hubbard, and described at page 105. The patentee, however, has not only claimed these, but much more, as "the hinges, the carriage and parallel beam, the pitman, and joints as there applied; together with the general construction of the machine, or the combination of the parts above mentioned, with the superficial cross pieces, supporters, knife, axle, &c., for the purpose set forth."

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13. For *Preserving Timber from decay;* Forrest Shepherd, Fredericksburg, Spottsylvania county, Virginia, October 8.

The wood is first to be steamed, or boiled, to "destroy the sap, or principle of decay," and after this to be immersed in pyroligneous acid, until saturated. The patentee says that he also preserves wood from decay, and from destruction by worms, by boiling it in a solution of sulphate of iron, sulphate of alumine, and muriate of soda; or, in other words, in a solution of copperas, alum, and common salt, taking half an ounce of each to a gallon of water. This is all the information given, and no claim is made.

We apprehend that the foregoing directions are altogether empirical, and that the patentee has been guided more by his hopes than by his experience, which ought, in such a case, to be the result of long continued and varied observation. A patent was lately obtained for saturating timber with lime, which was to neutralize the acid supposed to be contained in it; in the present instance, it is to be made to imbibe as much acid as possible; these views are theoretical, or rather hypothetical, and must not be depended upon as guides. The foregoing specification makes no claim, offers little or nothing that is new, and merely lays before us several recipes, from which to make a choice. The saline solutions named will do much towards rendering the wood incombustible, if they do not protect it against the attacks of the dry rot.

14. For machinery for making *Horse or Ox Shoes;* Ezekiel Davis, Barre, and Samuel Field, Oakham, Worcester county, Massachusetts, October 8.

In the lower part of a very stout frame of cast-iron, a horizontal spindle is to run, in the manner of a lathe mandrel; one end of this spindle is to project through a collar, and to carry a kind of chuck, the face of which is to be grooved, so as to form a mould, into which the heated iron is to be forced in order to convert it into shoes. This moulding face is to be about sixteen inches in diameter, and the groove about two inches clear of its edge. When horse shoes are to be formed, the indentations for two of them are contained in the circle, two cutters, or chisels, being placed in it to divide the iron; for ox shoes, four such cutters are used. There are to be creasing dies, corresponding with the number of shoes, on which are raised as many projections as there are nails to be employed. A punch, or punches, operated upon by cams, and passing through the moulder are to throw the shoes out of the groove.

In order to force the iron into the moulding groove, there is a roller revolving vertically, the lower end of which roller projects through a collar, and bears against the face of the moulder. The heated bar is to be passed through an opening, or notch, which guides it between the roller and the groove, by which it is to receive its form.

"The invention claimed is the plate, or mould, and the manner in which that, the spindle, and roller, are placed to produce the effect; the punches to throw out the shoe, and the application of water to cool the mould; and the slide to assist in throwing off the shoe."

We do not see in this machinery any thing calculated to remove the difficulties which have been hitherto encountered in the attempts to make horse shoes by rolling. There has in every instance, we believe, been a considerable waste of metal, and fins have been left upon the edges, which not only increase the waste, but are difficult to remove; and, after all, the horse shoe is not completed by the machine, but has to undergo considerable forging to prepare it for use. We predict, therefore, that it will prove a total failure.

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15. For an improvement in the *Plough;* Joseph Cromwell, Cynthiana, Harrison county, Kentucky, October 9.

The land side, share, and mould board, are each to be of wrought iron. The land side and share are to be connected at the point by welding, or otherwise, but are to be separated from the mould board. The share is to be confined to the mould board by means of a staple, or socket. "The improvements claimed, consist of the means by which the share is confined to the mould board, and the hooks by which the beam and land side are confined together "

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17. For an improvement in the *Machine for Shelling Corn;* Timothy Wellman, Jr., Brookline, Windham county, Vermont, October 9.

This corn shelling machine is, in all its essential points, the same with that which was first invented, and for which a patent was obtained, upwards of thirty years ago. It consists of a cylinder set with teeth, with a concave similarly armed, and borne up against it by means of springs, to adapt it to ears of different sizes. The claim made is to "the shell (or concave) being made capable of being elevated, or depressed, by large or small ears of corn, which enables it to shell all sizes of corn with equal facility."

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17. For a *Cooking Stove;* Covington Wilson, city of New York, October 10.

This stove is of cast-iron, and may be said to consist of two oblong rectangular boxes, placed one above the other; the lower box, or division, of which contains the grate, and the oven. This lower part may be about twice the length and depth of the grate, the latter being formed with front and bottom bars, in the usual manner of grates for anthracite; this grate is contained entirely within the lower division, and when the front bars are enclosed within doors fixed for that purpose, the front of the box has no projection on it. That portion of this lower compartment not occupied by the grate, constitutes the oven, which is heated both by the end and back plates of the grate, the oven being consequently in the form of a double L. There are doors at each end, and also at the back, of this compartment, opening into the oven, and the lower part of the grate is but little elevated above the plate which forms the bottom of the oven. There is an ash pit under the fire; but both this, and the front of the grate, may be closed by a fender, and by doors, constructed for the purpose, so as to govern the draft.

The upper, or cooking, compartment may be of the same dimensions with the lower, one plate forming the bottom of the former, and the top of the latter. It has an opening in front, which may be closed by sliding doors. Within this part, pots or kettles of any kind are to be placed; it has a flue at its back, extending up to the top plate, where a pipe may be attached. That part of the bottom plate of this compartment which is immediately over the fire, may be taken out, so as to expose such articles as require it, to its direct action. The stove has legs, to elevate it to a sufficient height above the floor.

"The claim is to "the placing the fire chamber in the middle of the oven, so that the latter may receive the heat of the three sides thereof at once;—the plan of closing the ash pit with a fender, so as to answer the purpose of an oven, to bake or broil by the heat of the bottom of the fire of the grate;—the arrangement of the cooking chamber with its movable section and chimney, by the joint management of which the doors of said chamber may be used as dampers to regulate the draft."

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18. For a *Machine for Punching Metals;* Levi C. Bunnell, Otsego, Otsego county, New York, October 10.

"The general arrangement of the machine" described in the specification of this patent, constitutes the claim. Its foundation is a block of wood, eight feet long, ten inches wide, and eight thick, and the apparatus for punching is situated at the middle of this block. One end of a lever works upon a pin passed through strong cheeks, and forms a cam, or eccentric, which, when the lever is brought down, acts upon a driver, that descends perpendicularly into the block, and has on its lower end the punch, which extends down to about the middle of the block. The driver is raised by springs when the lever is lifted. The die plate, or bed piece, is placed on the lower side of a mortise made through the block, and into this mortise the piece to be punched must be passed. This is "the general arrangement of the machine," which appears not to contain one single thing that is worthy of being patented. It is very much like several of those machines used for gumming mill saws, but is inferior to such of them as have a bed block entirely of cast iron, as much of the power employed will be lost, from the elasticity of the wood.

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19. For apparatus for *Tightening Rigging;* David Stackpole, Portland, Cumberland county, Maine, October 10.

This machine is intended for setting up, or tightening, the shrouds and other rigging on board of vessels. It consists of an iron screw, that plays into nuts, supported in an iron frame. The screw has a hole through the head of it, in which to insert the lever by which it is to be turned; its length must be regulated by the nature of the service it is to perform. One of these instruments is to be fixed to every shroud, or stay. The bottom end of the frame is to be attached to the chain plates, and the head of the screw to the shroud, or rigging, by means of a swivel in the form of a stirrup, and a thimble.

The foregoing contains the whole description, and nearly in the words of the patentee.

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20. For a *Machine for Moulding and Pressing Bricks;* Nathaniel Adams, Cromwell, Orange county, New York. First patented June 22, 1832. Patent surrendered, and reissued upon an amended specification, October 14.

The patent, as formerly taken, (see page 229, vol. vi.,) was for "Grinding or preparing clay for bricks, and for moulding and pressing the same." In the present specification, the grinding apparatus is wholly omitted, the patent being confined to the press, and the claim made is as follows:—"In this machine, the follower, and the apparatus used for raising, depressing, or spreading it, whether used in connection with the contrivance for moving the mould by pinion and rack, or in any other manner, for the purpose within mentioned, I claim as my invention."

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21. For an improvement in the common *Cooking Stove;* Henry W. Camp, Owego, Tioga county, New York, October 14.

What are called improvements in this stove, consist in the partic-

ular manner of arranging the respective parts, and more especially the flues.

"The improvements claimed are principally as follows.

"1st. In the form and construction of the flues and dampers, for the purpose of directing and regulating the fire; being so constructed as to cause a draught of heat both ways, and equalize or turn it one way or the other, by simply moving one or both dampers, so as to apply the heat where it may be needed, and turn it under the oven, or not, or partially so, for baking with greater safety, and better. The heat being by this process distributed equally, if necessary, through the whole stove, and applied so directly on the boilers, or cooking utensils, or oven, as to require less fuel than any other differently constructed stove, or fireplace, whatever, to furnish the same facilities.

"2d. In the form and construction of the fire hearth, comprising an ordinary hearth on the top plate, for ordinary use and convenience, and a sunk hearth under it, which can, with the sunk plate within the stove, contain convenient quantities of coals and ashes for cooking, and forms a receptacle for ashes from the burning fuel, which is upheld by the grate above described; by means of this and the draught, made to burn freely and advantageously. This draught being caused and increased or diminished by means of a hole in the centre of the upper plate of the hearth, and the partial or entire removal of the plate, which is removed entirely to admit of a gridiron, or other cooking utensil."

We have not yet passed half way through the claims, and will, therefore, to save space, give a mere outline of the remainder.

4th. The situation of the main flue, and the dampers by which it is governed.

5th. The formation of the perpendicular plates, which form the flues, &c.

6th. The formation of the top plate, and the location of the four boilers.

7th. The form and location of the fire grate, &c.

We have found the claim too long for insertion, and are very apprehensive that, if tested in court, the patentee will learn that he has made it *too broad* also. The basis upon which a patent must be sustained, is the *invention*, and not the *claim*, of the applicant; but, as in the case before us, patentees are very apt to mistake the one for the other.

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22. For an improvement in Hull's *Portable Bake-oven;* Henry Caldwell, Owego, Tioga county, New York, October 14.

We shall not look back after Hull's oven, to see how that was made, but describe at once that now presented to us, which is "of tin and iron, twenty inches in length, by fourteen in breadth, and fourteen in height, independently of the legs, or supporters;" and so far as we can ascertain from the picture and description, it is an oblong box, formed of single plates, with a door in the front, a re-

ceptacle for fuel underneath, and a flue, or pipe, running up at the back part, to connect with a stove pipe.

"The improvements claimed are as follows. 1st. In the application of the fire to the oven. 2d. In the pipe for carrying off the smoke, or fumes, from the fire used in the stove part, instead of suffering it to escape into the room. 3d. In the cylinder, or covering, around the pipe inside of the oven, called the protection. 4th. In the stove part being so constructed that it may be used for warming houses."

It is quite obvious that, if Hull's oven allowed the smoke and fumes to escape into the room, it required improvement; but the improvement made, although it may be new to Hull's oven, is certainly very old in its application to others. How novel it may be, also, to place a fire so that it may warm a room, as well as roast a loin of mutton, we have yet to learn. It has been more frequently attempted, and found of more difficult attainment, to keep the heat in, than to let it out of, a cooking apparatus.

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23. For a *Furnace for Heating Bar Iron with Anthracite and Bituminous Coal combined;* Henry Burden, Troy, Rensselaer county, New York, October 14.

The patentee states that the common method of constructing furnaces for heating bar iron by anthracite, is to make them about three feet wide, and four or five long, with grates of these dimensions, and a door at one end for admitting the fuel, and the bars to be heated; the grates have on them a layer of three or four inches, in thickness, of ignited anthracite, upon which the bars are laid; but as flame from this fuel will not fill the space between the iron and the arch, and the heat is unequally distributed, the draft through the grate being more obstructed in one part than in another, the bars are frequently overheated, burnt, or melted, in spots.

To remedy this defect, the improved furnace is lengthened about one foot, and furnished with a door at each end; the anthracite is laid on the grate as usual, and when the bars are heated to such a degree as not to endanger their burning, the hinder door is opened, and a small portion of bituminous coal thrown into the back part of the furnace, which, flashing into flame, fills the furnace therewith as it passes over the iron in its way to the chimney, and equalizes the heat of the bars.

The improvements claimed are, "First. Making the furnace with a door at the back end, so as to admit of the bituminous coal being put into the back part of the furnace. Secondly. Using the bituminous coal on a part of the grate at the back part of the furnace, reserved for that purpose, which gives the coal an opportunity of ignition, as well as could be by a reverberatory or puddling furnace, before it comes in contact with the iron. Thirdly. In combining the use of anthracite and bituminous coal, for the purpose of heating bar, or other iron, at the same time igniting each in separate parts of the furnace."

From the nature of the thing, as set forth, and the known talents and experience of the patentee, we have no doubt whatever that the foregoing is a real and great improvement in the process to which it appertains.

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24. For a *Machine for Planting Corn;* Henry Blair, Glenn-ross, Montgomery county, Maryland, October 14.

This planting machine does not differ in its mode of action, and but slightly in the arrangement of its parts, from others that have been constructed for the same purpose. A frame is made, which is sustained by two wheels made fast upon a common axis. This axis carries a hollow cylinder, from which the corn is to be dropped through holes at suitable distances; a hopper to contain the seed corn surmounts, and fits on to, this cylinder, but not so as to impede its revolution, which is effected by the wheels. A shovel plough, attached to the frame, precedes the dropping cylinder, and two coverers, or scrapers, follow it, and behind them a harrow also is attached to the frame. The machine is to be drawn and guided in the manner of a plough. The claim is to "the combination and arrangement of the several parts."

Since a late decision in the Circuit Court of the United States, sustaining a claim to the combination and general arrangement of a patented machine, this form of claim has become quite fashionable, and appears to be thought talismanic; it will be found, however, that such combination and arrangement must be substantially new, and must differ essentially from all things for the same purpose before known or used, as a defect in a thing itself is not to be cured by cabalistical words.

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25. For an improvement in the *Power Loom,* for weaving diaper, and other figured fabrics; James M. Hoggan, an alien, who has resided two years in the United States; New Haven, Connecticut, October 14.

We shall not attempt to epitomize the description of this loom, which is of great length, and refers to drawings, in which the machine is minutely and fully represented. Many parts of it are, of course, perfectly similar to the power looms previously in use; the running gear, and the mode of communicating the power, do not differ from those employed in the broadcloth power loom. The points claimed relate exclusively to the construction and arrangement of the parts by which the figures are formed.

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26. For an improvement in the *Apparatus for Distillation;* Joseph T. Dwyer, Nashville, Tennessee. An alien, who has declared his intention to become a citizen of the United States; October 14.

On the 19th of November, 1833, a patent for a similar object was obtained by the same person. This was noticed at p. 264, vol. xiii. Although the mode now described may be said to be similar in prin-

ciple with the former, there is considerable difference in the manner of carrying this principle into effect. A tube rises vertically from the top of a still head, and passes through the centre of the bottom of a round tub, formed like a washing tub, and within this is placed the apparatus alluded to. A flat, metallic drum, or hollow disk, stands a little above the bottom of the tub, and the vapour from the still passes into this drum, through the tube above mentioned. Parallel to this first drum, and at a convenient distance above it, within the tub, is placed a similar drum, or disk; and a number of tubes, bent so as to form a semicircle, connect these two drums together, by entering through their cylindrical peripheries. From the centre of the upper drum, or hollow disk, a tube rises, which conveys the vapour into an ordinary worm, or cooler. As a portion of the less volatile vapour will be condensed in the upper drum, a tube leads down from its lower side, into, or through, the first named drum, so as to re-convey it into the still. The claim is "the general arrangement herein stated."

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27. For *Curing Smokey Chimnies;* Urban B. A. Lange, city of Philadelphia. An alien, who has resided two years in the United States; October 14.

This patented apparatus consists of two sets of slats, fixed in a suitable frame, and placed like those of venetian blinds. The two frames are to be inclined towards each other, like the two sides of a roof, the slats pointing upwards. This is to be placed on the top of the chimney, and over it a case, or box, open at the sides, which case, or box, is to prevent the blowing of wind down the chimney. The affair is not very clearly described, nor is there any claim made. Like other contrivances for the same purpose, it will probably sometimes succeed, and at others fail.

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28. For a new and useful mode of *Cutting Shoes;* Samuel Hayner, Malden, Middlesex county, Massachusetts, October 16.

This improvement is called the "Perpetual Shoe Pattern," and is said to consist in the applying in a suitable frame any number of shoe shapes, so arranged as to leave the least possible space between them. These shapes are to be made of pasteboard, or of any other soft material. The leather is first to be cut into strips, of such width as will suit the frame containing the shapes, and these strips are to be placed on each other, so as to have as many thicknesses as can be conveniently cut through at once. The claim is to "the combination in successive order of any desired number of shoe patterns, for the purpose of being applied by the manufacturer, in cutting out any number of shoes he may require, with the least expense of time and stock."

The practical *clicker* must judge of the difficulty of cutting accurately, with a knife, through several skins at the same time, and also

of the convenience with which such patterns can be used when fixed in frames. The drawings have no "written references."

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29. For the *Application of Caoutchouc to Ropes* for dragging Cars on Inclined Planes, &c.; Patrick Markie, city of New York, October 16.

The specification closes with the remark, that "A solution of India rubber has been in use for some time past, in rendering cloths impermeable to moisture, for making elastic shoes, and for many other purposes, but has never been employed on ropes used on the inclined planes of railways, or in the shafts of mines, for which specific purpose I claim a patent."

The foregoing patent has been surrendered, and a new one issued, the specification of which we shall publish in due course. In the mean time, we will observe, that India rubber ropes, for railways, are advertised among other imported articles.

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30. For a *Cotton Press;* Thomas H. Scarborough, Brownsville, Haywood county, Tennessee, October 16.

The present patent is taken for an improvement on a press, for which one was issued to Philemon White, on the 19th of February, 1827. A beam extends horizontally along, its two ends being guided between upright cheeks. A follower shaft descends from near the middle of this beam, forcing a follower down into a pressing box; the two ends of the beam are to be alternately brought down by levers and chains, and confined by bolts passing through holes in the cheeks. As this is a less convenient press than some others used for the same purpose, we shall not attempt a more particular description of it; nor could we offer much in favour of its novelty, even in its improved form.

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31. For *Tackle Blocks, or Pulleys, of Cast-iron;* James Barron, Esq., United States Navy, stationed at the Navy Yard, Philadelphia; October 20.

The claim made is to the forming the shell of this machine of cast iron, or any other cast metal; and it is observed that, although such a block may be much diminished in size, when compared with those in use, yet it will be sufficiently strong for all required purposes. It is further observed, that there are various blocks which are not called *tackle* blocks, but yet it is intended to claim the making the shell of *all* blocks in the way designated.

The shells of blocks have been frequently made of wrought iron, but we are not aware that they have been cast of that metal, because, when great strength is required in a small compass, wrought iron is manifestly preferable to cast, the latter, however, offering no small advantage in first cost. It is said in the *Traité Complet de Mécanique*, by *Borgnis*, p. 62 and 63, of vol. ii., that "the cases, or shells, of pulleys are made either of elm, or of iron," and that "figures 7,

10 and 13, represent compound blocks, with cases, or shells, of iron; these occupy less space than those of wood; but I am of opinion that, for compound blocks of large size, those of wood, properly strengthened by ferules, and bands of iron, are to be preferred; in the first place, because they are more to be depended upon; for experience has proved that iron is more subject to unforeseen accidents than wood, such as breaking, or bending; the defects in wood are apparent, and may be seen at first sight, whilst, on the contrary, those in iron sometimes elude the observation of persons of the greatest experience. Secondly, the little thickness usually given to the iron partitions which separate the sheeves, in order to obtain lightness, endangers the constant friction of the cords against each other, and against the edges of the iron, with which they come in contact in their passage."

These observations refer to wrought iron, and although the objections under the second head may be in a great degree obviated in cast-iron, we are of opinion that those under the first will apply with sufficient force to prevent the general adoption of the plan.

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32. For a *Machine for Turning and Channeling Horse Shoe Shapes;* Charles B. Reed, West Bridgewater, Plymouth county, Massachusetts, October 20.

This machine is very fully described, and very accurately represented in the drawing, leaving nothing to be desired on these points. Its respective parts, also, are arranged with much skill, and it appears more likely to effect the intended object than most of its predecessors. We, however, shall not attempt a particular description, in the absence of an engraving.

"The said Charles B. Reed claims as his own invention, so much of the said machine as is employed in the several particulars which follow, viz: that part which confines the iron when bent to the mould, and makes it conform to the mould, when the stamp performs its operation. Also that part which is employed in channeling and shaping the surface of the shoe by means of a stamp. Also that part which prevents the iron from twisting or turning, when the mould carries it under the stamp. Also that part thereof which disengages the mould from the shoe. And also that part thereof which discharges the shoe from the machine; all these several parts performing their labour at one operation of the machine."

There is at one end of this machine two vertical posts, which support the stamping, or rather the pressing, apparatus. At the lower part of this apparatus there is a die for channeling, and otherwise forming, the face of the shoe. The bar of iron is to be heated, and placed against proper rests, when a carriage, having on it a projecting mould, or pattern, of the shape of the inside of the shoe, is brought up against it by the action of a cam on a revolving shaft. This carries it under the die, which is then brought down by a pushing bar, acting on a toggle joint. When the bar is thus pressed, jaws close

upon it laterally, causing it to fit to the mould, and giving it the correct shape exteriorly.

There is, in such machines, one difficulty which it appears impossible to overcome, namely, that of distributing the metal by pressure in such a manner as that every part of the article made shall have its proper section; were the quantity of metal the same in every part, the giving to it the requisite form would be an easy task; but this is not the case with horse shoes, and, in fact, with but few of the articles usually made by the blacksmith.

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33. For a *Thrashing Machine;* John Brown, Jackson, Madison county, Tennessee, October 21.

We need not describe this machine, except in one particular point of its formation, this being the only thing claimed. The cylinder is grooved from end to end, in such a manner as to give to its section the form of saw teeth, and the vertical part of these teeth, which constitute the beaters, are faced with iron.

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34. For a *Mortising and Tenoning Machine;* Erastus M. Shaw, Brooklyn, King's county, New York, October 21.

The drawing of this machine does not exhibit those parts in detail upon which an estimate of its novelty and utility is dependent, and without an acquaintance with these, the points claimed cannot be understood; we therefore pass it over.

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35. For a *Rotary Cylinder Cannon;* John W. Cochran, Lowell, Middlesex county, Massachusetts, October 22.

It is believed by the inventor that "in actual service, either in attack or defence, the Rotary Cylinder Cannon will constitute a most formidable battery, being so constructed that discharges to almost any given or requisite number, and in rapid succession, and in a very limited period, may be made with accuracy, and with as unerring aim as with any other ordnance."

So far every thing is quite *promising;* but the value of promises, all will admit, is dependent upon the manner in which they are fulfilled, and, for our own part, we had rather be among those to be fired at, than in the company of the cannoneers, when this gun is discharged, as we should be much more in fear of the breech than of the ball. The barrel part of these guns is to be formed and mounted upon a carriage as usual, but the breech is to consist of a solid metallic cylinder, the periphery of which is to bear against the bore of the cannon, and to be capable of revolving upon gudgeons. This cylinder is to be bored so as to form any desired number of chambers, which are to receive the charges, and these are to be brought round in succession, so as to coincide with the bore of the gun. The breech is to be made to revolve by an endless screw working in a toothed wheel, and there is a contrivance intended to deposit, upon a nipple, percussion caps, which are to be exploded by a hammer. To render this gun the more formidable, it is represented in the drawing as double barrel-

led, the two barrels to be discharged at the same time, two chambers being excavated in the cylinder, side by side.

We think it very probable that the patentee would never have needed a patent, excepting, perhaps, a patent coffin, had he, before seeking to obtain it, "made, constructed, and applied to use, his said invention or discovery." Our reasons for this opinion will not be required by those who have any knowledge upon the subject, and we cannot take time to prepare a horn book for others. Even the firing of ordnance by percussion locks has been attended with difficulties of no ordinary character, as is well known to many who have tried it.

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36. For an improvement in the construction of *Pumps;* Joel Farnam, Stillwater, Saratoga county, New York, October 22.

The cylinder of this pump is placed horizontally, being firmly secured upon a bench by bolts passing through flanches, or projecting ears. The piston rod passes through a stuffing box at one end, the other end being entirely closed. Upon the piston rod there is a rack, and the rod is moved backward and forward by a vertical lever, having a circular segment, furnished with teeth, at its lower end. The water is received through openings in the middle of the cylinder, at its under side, and is discharged through a pipe similarly situated at its top. These openings are enclosed by projecting chambers on the upper and lower sides of the piston; the internal arrangement of the cylinder, with its openings, valves, and chambers, are not represented in the drawing, which shows nothing more than the outside form of the instrument. It is possible that, by a close study of the specification, we might arrive at some knowledge of the interior, but this part ought to have been exhibited most distinctly in the drawing, which, without it, has but little value.

The points claimed "are the receiving and discharging the water through the cylinder, by means of arms, together with the peculiar form and combination to effect that purpose. But the most essential advantage which I claim as effected by this combination, is, that no dependence is placed on bolts or packing to keep it from leaking, the water having no chance to escape but through the solid metal, except through the stuffing box."

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37. For a *Still;* John Wright, city of New York, October 22.

It is here intended to produce alcohol from whiskey at one running, and the construction of the head of the still by which this is to be effected, is represented in the drawing, but no claim whatever is made. There are parts of the apparatus which are not new, and it is not the province of others to tell the patentee how much of it he has invented; and, indeed, were we to do so, it is not unlikely that he would think our measure a false one. Although there is nothing new in the principle of this still, we think that there is quite enough in its particular arrangement upon which to found a valid claim.

38. For a machine or apparatus for *Tanning Leather;* Lemuel C. Dudley, and Samuel Brooks, Portland, Cumberland county, Maine, October 23.

We have here again a patent without any claim, and without much novelty, excepting in the application of steam to a purpose which might be more readily and economically effected in other ways.

There is to be a leech, or vat, above ground, for preparing the tanning liquor, and a reservoir attached to it to receive the liquor as it passes from the leech; it is thence to be conducted into a long tube, on the under side of which there is a number of cocks, to which the skins or hides to be tanned, are to be attached. For this purpose, they are to be formed into bags, as is done in the making of morocco leather. The tanning liquor is to ooze through the skins, and to be caught in a large tub. "From the receiver the liquor is forced back through a lead pipe, by means of a steam boiler, which is connected with the receiver by another lead pipe." This is all we hear about the steam, and as respects the process described, it has been sufficiently tried to prove that it will not make good leather, nor would a claim to it render it new, when it is not so in fact.

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39. For an improvement in the *Running Gears of Rail-road Carriages;* James Stimpson, city of Baltimore, October 23.

This improvement consists simply in dividing the axle of the hind wheels in two at the middle, and forming a flanch on each end, which may rise one-fourth of an inch, and fit into a corresponding cavity in a coupling box fixed under the centre of the carriage. The object to be attained is to allow the hind wheels to run with different velocities upon curved parts of the road, and thus to follow the fore wheels, the cone upon the tread of which will guide them correctly; whilst the vibration of the axles, to preserve their parallelism, is rendered unnecessary. The claim is to "the application of the joint to one of the axles of any description of rail-road carriages and locomotives, whereby to allow the hind wheels to yield to the direction required to be given by any change in the direction of the road; or to the conical form of the wheels, upon the fore axle, or any other mode whereby the same object is attained by the same principle of action, or construction; and also for all other carriages to which it may be beneficially applied."

We do not perceive the difference in principle, or in effect, between this plan, and that of allowing one of the hind wheels to turn on the axle, whilst the other is fastened thereto; a practice which was adopted on rail-road cars, many years since.

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40. For a *Machine for Boring Timber;* Benjamin Knight, Cranston, Providence county, Rhode Island, October 23.

This is a patent for a "Machine for boring timber for mortising in the framing of buildings, of all descriptions." The machine is to be attached, by clamps of a peculiar construction, to the timber to be

bored. The auger is to be turned by a crank acting upon a bevil gear, and the whole apparatus is so constructed as greatly to facilitate the operation of boring. The claim is to "a slide placed on the main frame, and capable of being moved from end to end thereof, without removing the frame from the timber to be bored. And also the clamps for the purpose of holding the frame to the timber."

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41. For *Wheels for Rail-road Cars and Locomotives;* James Stimpson, city of Baltimore, October 23.

These wheels are to be made wholly of wrought iron, with the exception of the nave, or hub. The spokes are to be equal in width to the rim of the wheel, and they are to have a rib on each side, so that a transverse section of them will be in the form of a †; they are to be made by rolling, and are to be laid in the flask in which the hub is moulded, so that their inner ends shall be embraced by it; their outer ends being so formed as to adapt them to the rim. The tread and flanch forming the exterior of the rim, are to be of the usual shape; upon its interior there are to be two projections, one of which at about the middle part of the rim, may constitute a fillet of half, or five-eighths of, an inch thickness and rise, and the other a flanch, projecting inwards, on the side opposite to that on the tread. These are intended to strengthen the rim, without the necessity of using a large portion of metal.

The rims are to be made by rolling, which it is intended to do with such accuracy as to obviate the necessity of turning them. The ends of the spokes, and the interior of the rim, being properly adapted to each other, the latter is to be heated and placed on the former, when, by its contraction in cooling, the two parts will, by means of notches, or recesses, become firmly united, without the necessity of bolts, or screws.

The claim is to "the internal flanches, or ribs, within the internal periphery of the rim of the wheel, and the form, and mode, of fitting the spokes, so as to connect them and the rim together without screw-bolts, or rivets."

We have no doubt of the possibility of making wheels in the way above pointed out, or of their goodness when made; but we have at present no works for rolling edge rails, for rail-roads, nor are we likely to be able to compete with the English in this manufacture, for some time to come; yet the rolling of them could be more readily accomplished than that of the rims in question; we apprehend, therefore, that there is but little prospect of seeing the foregoing plan experimentally tested, on this side of the Atlantic, in time to reward the inventor, and to repay the expense of his labour.

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42. For a *Machine for Making or Turning Horse Shoes;* Elisha Tolles, Winchester, Litchfield county, Connecticut, October 24.

(See specification.)

43. For an *Acoustic Drum, or Membrane, for Conveying Sounds;* Samuel Sawyer, city of Boston, October 24.

The invention here claimed consists in the application of some thin membrane, such as parchment, bladder, gum elastic, or other suitable material, over one or both ends of a tube, pipe, or hose, so as to make it perfectly air tight, and still to admit of the free passage of sound. Judging from the general tenor of the specification, it would appear that the application of this contrivance to the diving bell, and diving dresses, was that principally contemplated by the patentee. When used for this purpose, he proposes to place a valve, or valves, in the tube, or hose, which would be closed by the rushing up of air, in case the membrane should become ruptured, although at other times it would remain open.

The patentee says that "by the application and use of said drums, or membranes, and the valve, or valves, in connection therewith, I am enabled to supply, by means of a forcing pump, all such quantities of fresh air as the explorers under water may require, through the same pipe, tube, or hose, which conveys the sound, and thus dispense with all other tubes and pipes and conductors, and thus render the apparatus for exploring under water more simple and less expensive.

"And also by compressing the air into a tube, tubes, or conductors of sound through the air, furnished with my said drum, or membrane, the articulation of sounds is rendered more perfect, and can be extended to a much greater distance than has yet been practised.

"Notwithstanding all that is hereinbefore described, my whole invention consists in the construction of a drum, or membrane, of suitable materials, nicely fitted, adjusted, and applied, to all tubes, hose, pipes, and conductors of sound, either in the air or in water, for the purpose of conveying sounds, and articulating words, and holding conversations;—and in the application of a safety valve in connexion with said drum, or membrane, as is hereinbefore described."

There is not any drawing accompanying the specification of this patent, and it certainly is one of those things which would "admit of drawings," and in this case, the law imperatively declares that they shall be made. It is of no use to say that the thing can be understood well enough without them; the law leaves no discretionary power respecting it. The drawings ought to have represented how the valve alluded to should be constructed, so as to render it sufficiently sensible to insure its action. It is not enough to say that there must be a "safety valve;" steam engines have safety valves, but, we apprehend, not of a kind to suit the hose, or tube, in question.

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44. For an improvement in the common *Riding Saddle;* Alonzo R. Dinsmoor, Goffstown, Hilisborough county, New Hampshire, October 25.

The covering of the seat of this saddle is to be in one entire piece, and drawn on whole; small jockeys are to extend back and cover the stirrup loops, and these are to be nailed on, the nails being covered

by a flat moulding; near the jockeys there are to be small pads. "The above are claimed as improvements, and are more fully represented in the *model*." The patentee adds, "The advantages of saddles constructed in this manner are, that they are more durable, easier to ride upon, and, by saving labour and stock, consequently cheaper." The foregoing contains nearly the whole specification.

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45. For *Boilers for Generating Steam;* (No. 1) John Goulding, Dedham, Norfolk county, Massachusetts, October 25.

This is to be a vertical, cylindrical boiler, the furnace and ash pit of which are situated at its lower end, much in the manner of the ordinary cylindrical stove. There are to be two interior cylinders concentric with that which forms the exterior of the boiler, but which are to terminate at some distance below its upper end; these two cylinders are to be connected together by a covering close at top, but not passing over the inner cylinder, as the water to be heated is contained between the outer and second cylinder, and is to flow over into the interior cylinder, which is closed at its lower termination over the fire. The flame and heat from the fuel pass up through the space between the interior cylinders, and the smoke escapes through pipes attached to the plate which closes their upper ends. A great number of tubes, open at each end, cross the space between these two cylinders, opening a free passage between the interior of the inner cylinder, and the space between the outer and second cylinders. These tubes are arranged spirally, so that one shall not directly cover another, and obstruct the general action of the heat from the fire.

In the specification, certain proportionate dimensions are given, but as these are not essential o the principle, we need not insert them, nor is it necessary to describe those subordinate parts, or modes of connexion, the necessity for which will be understood by those interested in the subject. These are all perfectly well represented in the drawings accompanying the specification, leaving nothing to desire in this particular.

The claim is to "the arrangement and combination of the second cylinder, with a third cylinder, and the pipes between them; all being placed within an outer case or cylinder; and for said arrangement and combination I herein claim letters patent."

The boiler given as an example has the outer cylinder six feet high, and two feet six inches in diameter. The second cylinder is four feet in height, and two feet three inches in diameter, its bottom reaching within about five inches of the bottom of the outer cylinder, and being supported upon legs. The inner cylinder is two feet three inches long, and six and a half inches in diameter, its top edge being, of course, even with the top edge of the second cylinder. The smoke pipes ascend from the covering of the two inner cylinders, and pass through the top of the boiler.

In the great variety of forms which have been given to steam boilers, there are some which, in part, resemble that before us; we think, however, that it possesses enough of novelty to sustain a pat-

ent. Whether the circulation of water within it will be such as to prevent incrustation in the tubes, and to obviate other difficulties which have been encountered in the employment of tubular boilers, is a question that must be decided by the test of experience; we know that a favourable opinion is entertained respecting them by some persons of judgment, and we hope that this opinion may be found to be correct.

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46. For *Boilers for Generating Steam;* (No. 2) John Goulding, Dedham, Norfolk county, Massachusetts, October 25.

The specification of this patent describes the same boiler with that which precedes it, and is, nearly throughout, couched in precisely the same terms. The only difference in the construction of the boiler, claimed in the present instance, is a pipe, or tube, attached to the upper end of the inner cylinder of the boiler, and bent into a semicircular form, so as to pass through the outer cylinder near its upper end; its semicircular form causes its mouth, or opening, outside of the boiler, to be downwards, and this is to dip under "water in an evaporator to prevent evaporation in the boiler. The under side of the curved pipe, or cylinder, should be a little higher than the surface of the fluid in the boiler. The fluid, by the act of ebullition, will flow through the pipe outwards; and it may afterwards be returned into the boiler, near the bottom, for reheating."

Although not very clearly expressed, it appears as though this curved tube is intended to prevent the rise of water into the steam pipe, in case of its too rapid ebullition; but for whatever purpose it is designed, we are unable to divine any reason for making it the subject of a separate patent; we think that it would have been proper to have included it with the other parts, in the former specification, as a mere variation in the mode of construction, it being nothing more than this; the patentee, however, has preferred another course, and, probably, may have good reason for so doing. The following is the claim:—

"That part of the above described boiler, which I herein claim as my improvement, and for which I now claim letters patent, is the extension of the [curved] cylinder over the head, or plate, [which unites the two inner cylinders,] and through the outside of the [outer] cylinder, so that the water, or other fluid, when raised above a boiling heat, may be thrown out of the boiler by its own ebullition."

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47. For *Making Dry Steam,* or preventing water from passing or going over, out of a Boiler into a Steam Pipe; John Goulding, Dedham, Norfolk county, Massachusetts, October 25.

A wisp, tangle, or irregular coil, of small wire, is to be placed in the steam chamber, or rather, we presume, in the steam pipe, so as to occupy six or eight inches of its lower part; or layers of woven wire, or other similar substance, may be substituted for the wisp of wire, although the latter is deemed the best. The doing this is the thing claimed.

48. For an improvement in *Valves for Steam Engines;* Thos. B. Stillman, city of New York, October 30.

The object proposed to be attained by this invention, "is to combine the common slide steam valve, with a cut off valve, so that both may be operated by the same eccentric, or cam, upon the same seat, and each retain its distinctive character, for the particular purposes of a steam and cut off valve."

Without a drawing we shall not attempt to explain the particular arrangement of this combined valve, the purpose of which is shown in the above quotation.

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49. For a *Rail-road Car to be Propelled by Animal Power;* Daniel W. Crocker, city of Philadelphia, October 30.

This is such a car as has frequently been described both here and in England, and has been essayed in both countries. The horse, or horses, by the power of which it is to be propelled, are to be placed in the car, on a movable floor, forming an endless chain, which passes over suitable drums, geared to the wheels which run upon the track.

The claim is to "the construction of the self-supporting chain; the double safety journals, and the arrangement of the several parts."

We have no objection to the name of the "self-supporting chain." because we believe that it will support itself; although we believe also, most firmly, that it will soon fail under the additional weight of the horse. The safety journals, so called, are formed by giving two different diameters to each end of the journals which sustain the drums, the smaller diameter running in a proper box, or bearing, and the larger diameter nearly touching a second bearing in the same box; the object of which is to sustain the shaft should the small end of the journal break off.

We are not able to discover in what respect this car is superior to those which have been already tried, if its superiority depends upon the things claimed; as we believe that one of these will not answer the intended purpose, and as the other has nothing to do with the general action of the machine, we expect but little from it.

If our readers will turn to vol. v. p. 296, they will find that such a carriage has not only been patented, but that among the things claimed in said patent, is the placing of horses in such a carriage, so that "they can travel in and upon the said carriage, either upon roads or railways, and by so doing, impart a power to move said carriage with accelerated or diminished speed, compared with that of the actual travel of the animals." It will be found also, that the thing was not then new, but had been repeatedly proposed. Mr. Stimpson, who was the patentee, had such a carriage constructed, which he used, in numerous trips, on the Baltimore and Ohio Rail-road; one of which trips was rendered memorable by the car running over and killing a cow, and being overturned, nearly proving fatal to some of the passengers. We mention this not as a fault peculiar to this kind of car, but merely as an event in its history, and in proof of

its existence. As Mr. Stimpson has essayed the contrivance, and appears to have given it up, we presume that he will not involve himself in law for the maintenance of his claim.

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50. For *Locomotive Cars for Railways;* John R. Sleeper, city of Philadelphia, October 30.

This is called an "Accelerating Horse Power Locomotive," and is, in its general construction and object, similar to the machine last described; dependence, however, is placed upon what is esteemed an improvement, as will be seen by the claim, which is to "the arrangement by which the motion of the car may be accelerated, retarded, or thrown out of gear, at will; the animal not necessarily altering his velocity." The apparatus for making these changes is described in very general terms, such as would not enable a person to carry the particular arrangement in the mind of the patentee into effect; and although every competent machinist can devise methods of his own for effecting the purpose intended, the thing ought not to have been so left.

To show that this idea is not new, we again quote from Mr. Stimpson's claim, the following sentence: "I also claim the application of the great principle, whereby a variation, more or less, is effected without varying that of the animals, as hereinbefore described."

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51. For an improved *Piston and Valve, &c. for Steam Engines;* Samuel Hall, Bassford, Nottingham county, England. Issued in pursuance of a special act of Congress, passed March 2, 1833. October 30.

In vol. xiii., p. 329, there is a notice of a patent granted to the same gentleman to whom that named in the caption, has issued. It now appears that some mistake was made by the agent employed in obtaining the former patent, which will, probably, be remedied by the one before us. The specification is of considerable length, but we can afford room for a very abridged account of it only. The whole title is "An improved Piston and Valve for Steam, Gas, and other Engines. Also, an improved method of lubricating the Pistons, Piston Rods, and Valves, or Cocks, of such Engines, and of condensing the Steam, and supplying Water to the bodies of such Steam Engines as are wrought by a Vacuum produced by condensation." This, it will be seen, is precisely the same title with that formerly noticed.

The improved Piston is so constructed, that, by the pressure of steam on either of its sides, the packing is forced into closer contact with the sides of the cylinder.

The improved Valve consists of two parts; first the sliding part, called the sliding frame; and secondly, a plate on which it works, called the seat plate. The former is made so that each side and end, or other part of the face, shall have its separate bearings on the latter, independently of the others.

The improved method of Lubricating consists in effecting, by a circuitous route through the valves, or cocks, working cylinders, and

other parts of steam and other engines, the separation of the oil, or lubricating matter, from the elastic or non-elastic fluids on their quitting such engines in commixture with each other, in order that the lubricating matter may be again employed for the same purpose.

The improved method of Condensing, is by means of a peculiar application of metallic surfaces, in conjunction with water, in a way particularly described. This part applies only to engines worked by means of a vacuum, which is the general plan in England, though not with us. The object of the arrangement is to cause the water resulting from the condensation of steam, to become itself the internal condensing water, and which is afterwards conducted again into the boiler, separated, as before mentioned, from the lubricating matter.

The apparatus by which these ends are attained, is fully represented in the drawings, and explained in the specification; the report of the English engineers who have examined and tested the invention, has been altogether approbatory; it is probable, however, that the whole may not prove as generally applicable in this country, as it has there; there are, however, parts of the plan which suit high, as well as low, pressure engines.

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52. For *Improvements in the Steam Engine;* Samuel Hall. Issued as the foregoing. October 30.

This patent is taken for improvements upon the modes of procedure, and the manner of construction, originally adopted by the patentee. He says: "The objects of my present invention, (which invention I confine to steam engines worked by a vacuum produced by condensation) are to condense, without injection of water, (for the purpose of creating as good a vacuum as is obtained and well known in injection engines,) the steam which passes through the engine for the working thereof; and also to condense for the most part, (if not wholly) that portion of steam which usually escapes through the safety valves into the atmosphere, when the pressure of the steam in the boiler is too high during the working of the engine, in order that the water resulting from the condensation of such steam may be returned into the boiler, and also further to supply so much more distilled water to the boilers of the above mentioned description of engines as is required to supply and replace any waste that may take place in the working thereof, in order to avoid the introduction of any water into the boiler, containing saline or other extraneous matters."

If we could with convenience present the illustrations of the plans of the patentee, contained in his drawings, we would gladly do so, but, as in the previous patent, we apprehend that the contrivances explained in this, will but rarely apply to our engines; as even those which we denominate low pressure, or condensing, are usually of a mongrel character, working under a force of steam, at least equal to double the pressure of the atmosphere.

53. For a *Conical Grinder for Grain;* Daniel and John Fitzgerald, city of New York, October 31.

This apparatus, in its working part, is similar in form and operation to other machines already in use for grinding grain. It consists of a conical stone running within two halves of a hollow cone of the same material, but these segments of a hollow cone are to be placed within a cast iron conical case, cast in two parts, to receive them. The claim is to "the manner of confining the concave stones in the case, and hanging the same, being on an angle of about forty-five degrees; with the shape and form of the case, and the manner of placing the hopper on the case."

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54. For a *Thrashing Machine;* John and Daniel Fitzgerald, city of New York, October 31.

The patentees claim "the form of the bearers; the ridges in the concave, and the form of the hoops and beaters attached to them."

As an example of the things invented on the present occasion, we give the description of the bearers. "The bearers to support the machine consist of cast iron plates, one foot and four inches in diameter, and half an inch thick, with a flanch round the edges projecting out one inch, and a projection on the lower parts forming the *pedsills.*"

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55. For a *Truss for the Cure of Hernia;* John L. Price, Nicholasville, Jessamine county, Kentucky, October 31.

Instead of a pad of the ordinary construction, a plano-convex ball of lead, the convexity terminating in an obtuse apex, is to be fixed to a belt which is to surround the body; the apex of the leaden ball passing into the ruptured cavity.

The manner of making and using the strap is described and figured, but there is not any claim made. Lead is the only article spoken of as employed to produce the pressure, but why the same mechanical effect should not be produced by other articles, it would not be easy to tell. We presume that the intention of this pad is to produce irritation, and adhesive inflammation; if so, it ought to be applied under the direction of a skilful surgeon, or it may produce much more harm than good.

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56. For an improvement in *Bedsteads;* Ezra Coleman, New Bedford, Massachusetts, October 31.

This "newly invented or discovered bedstead," will probably be rediscovered, or reinvented, by numerous discoverers or inventors now unborn, or who have not yet entered the lists. There are but few inventions which have been so repeatedly presented at the patent office for the first time; the reason, we suppose, is, because the contrivance is so obvious, that little, or no, inventive genius has been necessary to call it forth. The rails are to be furnished, at their opposite ends, with a right and a left handed screw, to which female screws in the posts are to be adapted.

After all the trials which have been made of this plan, its value has not been such, it seems, as to have made it generally known, no doubt because, in practice, it is a very defective affair, it being nearly impossible to make the two screws coincide, so that they shall both come to a shoulder at precisely the right place; but were the plan good, the patent would be of no value, as the thing belongs to the public.

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57. For a machine for *Shelling Corn;* Rodney Hoit, Miamisburg, Miami county, Ohio, October 31.

This corn shelling machine is more complex than the one first patented, thirty years ago, (see also No. 16,) but does not differ from it in its general construction and mode of action. A cylinder, with teeth upon its surface, is made to revolve within an adjustable concave. The cylinder is to be turned by a winch having a cog wheel on its shaft, which cog wheel takes into a pinion on the cylinder shaft, represented in the drawing, as of about one-fourth the size of the cog wheel. A riddle is placed beneath the cylinder, as has frequently been done in other machines for the same purpose, and there is, also, a cover placed over it. The cylinder and concave are each to be of cast iron, the former a foot in length, and seventeen and a half inches in diameter. To form it, staves, properly adapted to the purpose, are to be screwed upon wooden heads. The claims are to "the concave in which the cylinder works; the cylinder as formed with the metal surface, giving it the properties of a fly wheel; the form of the teeth on the concave; the spring of steel, or elastic wood," &c. &c. &c. We have already indicated the want of novelty in the general construction; this, it is true, is not claimed, but several particular parts which are so, have been previously employed for the same purpose.

Specifications of American Patents.

Description of a Gas Metre, for which a patent was obtained by James Bogardus, *of the city of New York, October 7th,* 1834.

The gas metre described in the specification attached to this patent, differs in its principle of action from all those which have preceded it, or, at all events, from those which have come to our knowledge. Its exterior form is that of an oval shade, such as are put over time pieces, the longest diameter of which is about nine inches, its shortest six or seven, and its height fourteen. This exterior part is to be made of cast iron, in two pieces, being divided by a vertical plane passing through its longer diameter, flanches being cast along its edges, to allow the two halves to be united by means of screws; this vessel has a bottom, so as to form a perfectly close box, and it stands upon short feet. On the front side of it there is an opening, formed in the casting, which is filled with glass, cemented in, air tight, and

affording a view of the index, and of the general operation of the machinery contained in the interior. In the lower part of this case there are two openings, one for the introduction of the gas from the reservoir, and another to allow of its exit to supply the burners.

We shall not attempt to describe specifically the construction of the interior, but merely to make known the general principles upon which the indications of this instrument depend. When the two shells are put together by their flanches, they are made to embrace a flexible diaphragm, of bladder, or air tight cloth, which is loose, or bagging, in the interior, so that when gas is forced in on one side, the diaphragm will pass over to the other, and come into contact, or nearly so, with the shell. The induction and exit apertures above spoken of, are connected with pipes, which are cast on to the bottom, and are so constructed that they can communicate with either side of the diaphragm, there being a movable cup, or cover, which is shifted at every vibration, thus producing an effect resembling that of the slide valve of a steam engine. The diaphragm, of which we have spoken, is in part embraced between plates of sheet tin, leaving its edges and upper part free to obey the pressure of the gas admitted; this sheet tin works on pivots at the lower end, and can, consequently, vibrate backward and forward with the diaphragm.

When the gas is admitted on one side, that on the other is forced out, by the action of the diaphragm upon it, and this, at the end of its vibration, reverses the communications between the induction and exit pipes, causing the gas to be admitted, and discharged, from the opposite sides. The same vibrating diaphragm acts also upon the wheel work by which the indices are moved, which point out the quantity of gas which has passed, by counting the vibrations, as one must necessarily be a measure of the other. The arrangement of the moving parts, as described in the specification, appears to be both simple and efficient; but it is to be considered as nothing more than an exemplification of the means by which the principles adopted may be carried into operation, but not limiting it thereto, as will fully appear by the extracts which we are about to furnish.

"The applicant proceeds, in the next place, to describe the principle of his invention. This principle consists in the action of a movable partition enclosed in an air tight vessel constructed substantially as aforesaid, and moved from side to side of said vessel by the current of gas acting in the vessel, successively on one side and on the other of this partition, by means of any machinery constructed in combination with said partition, substantially as aforesaid. This alternate action of the gas being effected by the action of the gas upon the partition, and the machinery combined with it, and moved and timed by the motions of the partition as aforesaid; the number of its operations being marked by an index combined with said partition, and moved by its motion, and so timed thereby, and by means of connecting machinery, as to indicate, with perfect certainty, the number of full or complete operations of the partition; the space through or in which the partition moves from side to side within the vessel, being, in fact,

the measure of the volume of gas which passes through the vessel at each full operation of said partition forward and back.

"But the applicant further describing the principle of his invention, observes, that the diaphragm may be varied much in its form, and in its points of support and action, and the cup may be varied in its form, or instead thereof, a sliding valve may be used, or a four-way-cock, or other valvular construction, with machinery respectively adapted thereto, may be used, to change the direction of the gas from side to side of the diaphragm, and any convenient machinery may be used to time the action of the cup, or valve, and of the index, and yet the mode of operation for measuring gas will be identical with the principle of this invention, if, in fact, there be within an air tight vessel a partition moved by the passing current of gas which acts alternately on its sides, by means of machinery moved and timed by the motion of said partition, and if the number of the movements of the said partition be indicated by machinery moved and timed by the motion of said partition, substantially as aforesaid.

"The applicant contemplates the application of this instrument to current water in all aqueducts, where, as in the use of gas, the quantity of water used or delivered, is to be ascertained. He contemplates the use of it, also, to the discovery of leaks in gas pipes, and in water pipes laid in the ground. This applicant also contemplates the use of this instrument to the measurement of wines and liquors, when running into hogsheads, and casks, and barrels, by combining an instrument constructed on this principle with a syphon.

"These are some of the modifications of its use, and there are obviously other applications of this principle, analagous to them; but those above mentioned sufficiently indicate the extent and variety of its applicability."

Specification of a patent for a machine for making or turning Horse Shoes. Granted to ELISHA TOLLES, *Winchester, Litchfield county, Connecticut, October 24th*, 1834.

Know all men by these presents, that I, Elisha Tolles, of Winchester, in the county of Litchfield, and state of Connecticut, have invented a new and useful machine for turning or making horse shoes, and that the following is a full and exact description thereof.

I make a bench of wood, or iron, or of the two combined, of sufficient strength to support the machinery, and sustain the pressure necessary to the operation to be performed. This bench has two parallel cheeks, placed at a distance of six or eight inches from each other, and of such length as may be necessary, say five or six feet. Between these cheeks, at what I will call the hind end of the machine, a sliding piece works backwards and forwards in grooves, being carried by a pitman attached to any sufficient motive power. This slide forms the bed upon which the piece of iron to form the shoe, is received and sustained, during the whole operation. On the

end of this slide, opposite to that to which the pitman is attached, a piece of iron rises, which is to give the form to the inner curve of the shoe. The end of this piece, which first comes into contact with the bar of iron, is rounded, and its sides are straight, the curving in of the hind or corked end of the shoe being given after its delivery from the machine. The bar of iron, of which the shoe is to be formed, being selected of a suitable size, and heated in a forge or furnace, is placed crosswise upon the bench, and just in front of the *former* on the slide, the latter being retracted. On the under side of the slide, there is a rack, which takes into a toothed wheel, upon a shaft crossing the hind end of the machine; this shaft carries cams, which act upon two levers, serving the purpose of shears to cut off the bar, and of stops to gauge it. When one of these levers is up, the other is down; and as bars are fed alternately from each side of the machine, a bar is passed under the raised end of one lever, and is stopped against the depressed end of the other; the slide then advancing, the raised lever, or shear, is depressed by the action of one of the cams, and the bar is cut off by it, the part of the bed immediately under it, forming the other edge of the shear. The piece thus cut off, is carried forward by the curved end of the slide to be turned, or formed into a shoe, its middle bearing against the beforenamed piece on the slide. At this moment, its two ends come into contact with two segment dies, working horizontally upon strong centres on the bench. The edges of these dies are so formed as to embrace the bar between them and the projecting piece upon the slide, giving the proper width to the shoe, and the proper shape to its outer edge.

As the slide advances, the bar to form the shoe is carried under another segmental die, vibrating upon gudgeons between two standards, which rise vertically from the bench.

The under side or face of this die, is so formed as to groove, punch, and give the entire shape to the outer surface of the shoe, whilst the bed of the slide upon which it rests, shapes the part which is to come into contact with the hoof. At the moment the slide comes into contact with the last mentioned, or vertical die, teeth upon each edge of the slide engage with corresponding teeth on the die, and they are thus made to act in perfect concert with each other. When the lateral dies act no longer on the bar, they are returned to their places by the action of springs, or weights, and as the slide returns, the hind end of the shoe, touching against them, is pushed off from the bed, and falls through between the cheeks of the bench. The vertical die is kept back against its bearing, so as to engage properly with the slide, by means of a weighted lever, spring, or otherwise. The drawing of this apparatus, deposited in the Patent Office, together with the written references thereunto annexed, will fully illustrate the construction and action of this machinery, and, as I believe, fully complies, in this respect, with the requirements of the patent law. I am aware that rollers, or parts of rollers, forming segment dies, have been used for forging, or giving form to various articles of iron; I do not, therefore, claim these, taken separately, or

alone, as of my invention; neither do I claim the cams, slide racks, or any of the other parts which I have described, in their individual characters; but what I do claim, and for which I ask a patent, is the general combination and arrangement of the several parts of this machine, as described, for effecting the purpose set forth, namely, the manufacturing of horse shoes; whether the said machine be constructed exactly in the manner described, or varied in any way which may be found expedient, whilst the general principle remains the same, and a similar result is obtained. ELISHA TOLLES.

TRANSLATIONS FROM FOREIGN JOURNALS.

On the Use of Anthracite in the Smelting Furnace of Vizille. By M. ROBIN, *Director of the Neiderbrunn Works.**

(Continued from page 269.)

I omit the details of this working, the results of which were uncertain, in order to avoid repetition in speaking of the trials that followed, which, from the experience already had, were conducted with more regularity.

After the blowing machine had been repaired, the furnace was again put in blast, Jan. 19, 1828.

In order that the accidents which might happen during this new trial, should be attributable to anthracite alone, the charges were regulated so that the quantity of ore was always a little under that which the coal could carry, so as always to produce gray castings; other qualities of casting would indicate a derangement in the furnace. When the trials on the combustible were completed, it would be time enough to ascertain how much ore could be melted.

The composition of the charge was scarcely varied during the essays upon this coal; it was composed of nearly two-thirds of the rich, and one-third of the poor, ore, and sometimes, besides, a small quantity of flux, to improve the slag, or scull. The experiment soon showed what composition of slag was most proper to assure the good working of the furnace. Upon this point, no variation from the composition of the slag of the coke furnace could be admitted; 30 to 33 per cent. of lime, 15 to 20 of alumine and magnesia, and of oxide of manganese, the remainder silex, were the principal proportions, from which they could not vary without encountering difficulties.

With less than 30 per cent. of lime, the slag was viscous, or slimy, cementing together the ashes of the anthracite, and forming deposites in the hearth, as well as in the boshes. By surpassing this proportion, the excess of lime adhered to the furnace, and melted it; an excess of magnesia gave also a very refractory slag, and in the ore of Halles, could only be exceeded by great care.

Instead of putting the furnace in blast with pure coke, it was in-

* Translated for this Journal, by S. V. Merrick.

teresting to know whether this could be done with half coke, and half anthracite; proportions at which the first trials had been stopped. The expense of coke made the success of this experiment of great importance to the establishment, since the coke had to be transported seventy-two miles. They proceeded to put the fire to the furnace as follows, with the precautions employed in the coke furnace, and with care to proportion the blast to the density of the new combustible.

The furnace was half filled with coal; during the heating, that which was consumed was replaced successively with charges composed of 600 lbs. of coals, and a like weight of ore; that is, about two-thirds the usual full charge.

They operated thus during twenty-three days, and made twenty-two runs; at this time the ore arrived at the tuyeres. The blast was given by two opposite tuyeres, with openings, twenty-three lines in diameter; the pressure of the mercury gauge, which was at first very feeble, was soon raised to 20.7 lines: at the end of three days, the charges filled the furnace entirely. This manner of operating produced no satisfactory results; it was impossible to make the furnace work well, after six days of varied attempts.

The blast passed through the charge with difficulty; it reacted on the tuyeres, and had much trouble to maintain itself towards the tymp; when it escaped from this part of the furnace, it projected the scoria with force beyond the boshes.

The charges descended slowly; the furnace was encumbered with anthracite, in dust, which checked the slag, otherwise scarce, from bathing and heating properly all parts below the boshes. The scoria was, besides, subject to the action of the blast, which reached also the metal, and rendered it so thick that it coagulated against the dam stone, from whence it was removed by pieces. To avoid this last inconvenience, a tuyere was opened opposite the tymp, so as to re-heat the front part of the boshes, and also to assist the ascent of the blast. The pressure was raised gradually to 5 in. 2 lines; but all these efforts were fruitless.

The third tuyere was suppressed, as it only had the effect of paralyzing the blast of one of those from the side; the furnace became dark, and the blast often threw out the scoria and small coal. The scoria, generally well fused, became, from time to time, black; the first casting observed was white: on the second day it was mottled, which proved that the furnace worked better; but it soon returned to the first quality, and thus alternated during many days. As only 20 to 22 charges descended during twenty-four hours, the melted material arrived slowly at the boshes. It was only in the sixteenth day after putting on the blast, that a feeble run of white iron was obtained.

To be relieved from this state, recourse was had to pure coke, in order that the trials might recommence from this point. It is possible the success would have been better, if the furnace had been filled with coals before putting in the charge, and if they had charged

with a little more ore, when the blast was commenced, and in place of roasted mineral, in dust, employed the crude ore in pieces; coke about the tuyeres would have permitted the blast to pass gradually, till it arrived at the ore.

In this way all the column of material would have been heated, and the draught facilitated, and by adapting the material to the state of fusion, they would have avoided another difficulty, which they feared; that of destroying the furnace, by pushing it too fast.

At the arrival of the coke before the tuyeres, the furnace recovered itself as by enchantment, the draft became excellent, the charges doubled their rapidity; the scoria, perfectly fluid, became white, shaded with blue on the surface, and presented on analysis mere traces of oxide of iron.

The first running gave iron mottled, almost gray; the flame at the mouth, which before had been sombre and feeble, mounted suddenly, and acquired a beauty which is one of the characteristics of the coke furnace.

In order not to waste the coke, they placed two new mouths to the tuyere, of eighteen lines diameter, blowing with a pressure of four inches one line. In spite of that, they made forty-two charges in twenty-four hours. Soon the first tenth, then the second tenth, of anthracite, added to the coke, was passed; at this time the poor roasted ore was replaced by crude ore; no change was remarked in the working of the furnace. With three-tenths of anthracite, the dust of the anthracite began to show itself, and there was an evident relaxation in the descent of the charges; the blast returned past the tuyere.

With half coke and half anthracite, the same phenomena occurred. At this moment, in place of the rich roasted ore, one-half of the same ore unroasted, or crude, was substituted; this alteration made no change towards a more perfect working of the furnace; they had now arrived at the point where the first trials were stopped; the furnace worked as well as with the coke; the scoria did not change for an instant; the castings were very gray, had a fine grain, and a remarkable tenacity.

The first three-tenths of anthracite, which had not presented difficulties, were charged very quickly, and in less than thirteen days, one-half had been added.

As the matter which was to run down from this period was unknown, they stopped longer to judge of the effect produced by every new proportion of anthracite; six-tenths, however, passed as well as the lower proportions. The working of the furnace was very regular with seven-tenths, but the casting was slightly mottled towards the end of this essay; they succeeded without trouble to bring it back to the gray. The gray pig, at six-tenths and seven-tenths of anthracite, was a gray less deeply marked than that obtained before; the grain close, but less uniform. The moment mottled iron appeared, the scoria became white.

During the whole of these essays, this law was constantly remarked

in the scoria; that for the gray pig, it was blueish, and for the casting slightly mottled, or mottled gray, of a perfect white; of a clear brown for the casting of Welsh mottled, and deep brown, or black, for the white iron. This *last* was produced sometimes with scoria, of good colour; then the quality was due to a sort of refining which is received on the hearth, when the blast struck forcibly against the scoria, and reached the naked iron, or rather when the metal became refined by exposure to the blast above the tuyeres, by the too slow descent of the charge.

The working of the furnace, which till this time had been regular, changed with eight-tenths anthracite; the dust of the coal, which was already abundant, commenced to clog; the draught became sensibly more variable; the air was returned more forcibly by the tuyeres; the casting became mottled, then white, and having returned to mottle, changed again; the scoria assumed every shadow of colour, even to blue; the material became scarcely red at the furnace mouth, the flame became feeble, and the charges commenced to descend irregularly, often by sudden falls. The furnace was not difficult to manage in this state; but the attempts of every kind, made during nine days, to restore it to a good working order, were fruitless. They then charged with eight-tenths of anthracite, the same phenomena continuing to be manifested, in a still more decided manner. The descent of the charges was extraordinarily slow, the whole iron becoming clammy; their fracture, however, showing some mottled parts.

From these trials, it was easy to see that it would be impossible to make the furnace work with nine-tenths, or even eight-tenths, of anthracite; it was, however, decided that the experiments should be pushed to the extreme, in spite of all risks to the furnace; they therefore, during four days, charged with pure anthracite. When it took the place of the mixture, the labour, already so hard, was further augmented. They remarked, but in a more decided manner, the same accidents which occurred when the furnace was put in blast with half anthracite. The draught and flame at the mouth were almost extinct; the blast returned by the tymp, and by the tuyeres, throwing out frequently the scoria, the coal, and even the metal; this became so thick, that they were compelled to draw it out almost entire from the hearth, by blows.

It was only by raising the dam, stopping up the tymp with clay, and by making there, for two or three hours, holes which allowed the scoria and iron to run out together, that they were able to obtain some masses of iron, which together weighed a few hundred kilograms only.

The casting from the anthracite was of a grayish white, facettes very small, a little radiating; its surface was covered with small bubbles, proceeding from the effervescence which strong iron displays, when submitted to a refining. The fractures frequently showed hollows, which were coated with irised arborescences, like those often seen in native silver.

The scoria which accompanied the small runnings of iron were demi-vitrious, of a yellowish brown colour, and, of course, easily removed. Before the arrival at the tuyeres of the charges, containing seven-tenths of anthracite, which were worked after the pure anthracite, to restore the furnace to action, its situation grew worse, the little holes before spoken of, could not be continued a long time, because the half refined iron attached itself to the walls, and, in a great measure, choked the furnace. The progress of this new evil was arrested by making a hole as low as possible, by which the melted matters were allowed to run out during certain hours; from time to time these openings were closed, to maintain the heat in the upper part of the furnace.

On the arrival of the new charges below, the furnace soon recovered itself; but to get rid of the choking, they were obliged to return to pure coke.

It would be tedious to speak of all the means used to maintain the furnace in good working order. It will be sufficient to state that the pressure of the blast was carried, during two days, from 7 to 7.4 in., with two openings of 30 lines; whilst for the five-tenths of anthracite, they only employed tuyere irons of 24 lines opening, and with 4 in. $6\frac{1}{4}$ lines pressure; and for seven-tenths anthracite, the same tuyeres, with 5 in. $6\frac{1}{2}$ lines of pressure. As this enormous pressure given to the air was insufficient to carry it properly through the charge, it seemed probable that, if the column of material was curtailed in elevation, they could more readily obtain this effect. The charging was stopped till the burthen receded six feet, and then ten feet, below the mouth, but without success.

When the furnace was re-established by means of coke, they repassed in nine days, without meeting any accident, to a charge of seven-tenths anthracite, and stopped at this proportion, which was convenient for making some other essays, especially for finding the maximum of mineral which could be smelted under these circumstances. It was ascertained that they could produce grey metal, with charges composed of 200 of fuel to 310 of ore, (crude,) of which 100 was poor ore; but that beyond this limit, the iron became mottled. At this point they made twenty-one charges in twenty-four hours, and reduced only 3220 lbs. of metal, burning 2.60 of fuel to 1. of iron, and the ore yielded only 24.73 per cent. of metal. The furnace was difficult to manage. When the blast was urged, to hasten the descent of the charges, it did not pass through with sufficient ease, and part was lost at the tuyeres. It was thought that this inconvenience would disappear if the burthen had less height; and, for the third time in the course of these experiments, they allowed it to descend ten feet below the mouth.

This last attempt appeared to promise better results than the first essays, during which the furnace was already completely deranged; but the wind appeared to be thrown back as strongly, and the metal became white. The dust accumulated in the base of the furnace,

evidently opposed to the circulation of the air. The unexpected change in the quality of the iron arose, perhaps, from the circumstance that the material, spread upon a greater surface of the furnace, could not be properly heated; the flame being carried sometimes on one side, then on the other, left a part of the furnace to cool. It is probable that, in a furnace of thirty feet, with dimensions proportioned to this height, they would have obtained gray iron; but that would not have enabled the air to penetrate more readily.

The poor ore, charged in the proportion of one-third, was replaced by the rich; but by means of this new treatment, the furnace did not produce sufficient scoria, the work became dry, and the metal clammy. The roasted ore offered some difficulties, being in small pieces; they endeavoured to cement them with clay, to pass them in the state of bricks; but in this form they had not sufficient resistance, and would have been crushed in the furnace. Bricks of ore and quick lime presented the same inconvenience, and it was only with a proportion of lime too strong for fusion, that they could obtain sufficiently solid bricks; moreover as, in winter, they hardened slowly, this operation would have been impracticable.

No expedient could then be found to augment this feeble yield; whilst with pure coke, using the roasted mineral, producing only 38 per cent., and without pushing the blast beyond the degree indicated above, they burned 20,500 lbs. of coke by day, and obtained 120.74 lbs. of castings during the same time, using an equal weight of ore. As 620 lbs. of crude ore was the limit at which it was necessary to stop with seven-tenths anthracite, and 400 lbs. of pure coke had borne 636 lbs. of roasted ore, which required, without doubt, more heat for its reduction than a material containing much carbonic acid, it must be admitted that the coke can reduce more ore than the other coal. Besides, we have seen the castings approach to whiteness with each new proportion of anthracite. This effect must be attributed either to the nature of this combustible, or to the difficulty with which its dust permits the circulation of the quantity of air required to raise the temperature high enough. This is a doubtful point, which it is not possible to clear up.

On recommencing with the coke, after the derangement by the anthracite, an entire identity between all the phenomena which happened before and after this operation, was observed. The following table indicates the quantity of fuel burnt each twenty-four hours, with pure coke, and with different proportions of anthracite; it gives an idea of the slackening of the yield of the furnace, according as this proportion was increased. The anomaly which is remarked from the three-tenths and four-tenths of anthracite, occurs because they suppressed for the less proportion, a part of the roasted ore, as indicated above; from this time, the charges were reduced a little faster.

Proportions of Anthracite.	*Coke & Anth. burned in 24 h's.*
.0	10,250 kilograms.
.1	9,750 "
.2	8,780 "
.3	6,500 "
.4	7,250 "
.5	6,250 "
.6	5,250 "
.7	4,200 "
.8	3,750 "
.9	3,250 "
.10	2,500 "

The pig iron produced with the different proportions of anthracite were of good quality; made with a slight excess of combustible, they were very desirable for castings, because of their great tenacity; the others give, by the English method of refining, good iron. This result deserves to be mentioned, because, from the great quantity of pyrites contained in anthracite, sulphurous castings were to have been expected. This inconvenience has always been avoided when the proper proportion of lime was in the scoria.

The carbonates of iron, themselves, furnish to the scoria oxide of manganese, of which the base has a great affinity for sulphur. The scoria of the anthracite, pure, yielded on analysis, 1.96 per 100 of sulphur; the other scoria from five-tenths anthracite, contained 1.20.

The pig iron will then cost the following:

Casting from coke,	24.83 francs.
Those of .1 anthracite,	23.50 "
" .5 "	22.87 "
" .7 "	27.91 "

The smelting with half of each combustible was the least disadvantageous; with more coke, the cost of the castings increased, because of the increased price of this fuel. By employing, on the contrary, the greater proportion of anthracite, the general expense was increased, by reason of the diminished daily yield of the furnace.

The fusion of the carbonate of iron, by means of pure anthracite, has been resolved, scientifically speaking, at the foundry of Vizille. This operation has, however, been executed with great difficulty.

The establishment would have been able to proceed conveniently with the anthracite, in the proportion of five-tenths; but the company who attempted it, renounced the undertaking at the time when the iron trade, and more particularly the works using the English methods, were at a crisis which, even now, has not in many of them passed.

REPORT

To the Board of Directors of Bridges, Public Roads, and Mines, upon the Use of Heated Air in the Iron Works of Scotland and England. By M. Dufrenoy, *Engineer of Mines. Paris*, 1834.

[Translated for this Journal, by S. V. Merrick.]

Continued from p. 275.

EMPLOYMENT OF HEATED AIR IN CUPOLAS.

There are now many cupolas, in which the combustion is sustained by a current of heated air. The little attention paid in England to the consumption of coal, which is spread so profusely over the whole country, has induced them to trouble themselves but rarely to weigh the quantity used in the cupolas. This circumstance prevents my verifying with certainty the advantages which result from this plan. I think, nevertheless, that it will be useful to show the few documents which I have collected on this subject. I will give also a description of two kinds of apparatus adapted to the tops of cupolas.

At the Tyne Iron works, already spoken of, near Newcastle, there are two cupolas worked with heated air. They are supplied by the same apparatus which heats the air for the smelting furnace. These cupolas are circular, five and a half feet high, thirty inches diameter in the clear, constructed with fire brick, encased in cast iron. They receive the air through two tuyeres, placed one over the other, each two inches and three-quarters in diameter. From one of the proprietors, I learn that the consumption of these cupolas is 280 lbs. coke for each ton of iron melted. Casting on an average, one ton per hour. These cupolas have been constructed since the introduction of the hot air plan.

At Wednesbury, in the works of Lloyd, Forster & Co., the cupolas are rectangular; about seven feet high, with a space in the clear, of thirty-six by thirty inches. The air is introduced by two tuyeres, three inches in diameter. They cast in these furnaces, one ton of metal per hour, each operation lasting twenty minutes, consuming 260 pounds of coke;—before the adoption of hot air, the ton of iron required 400 pounds of coke. The greatest influence produced in these furnaces by the hot air, is, the rapid reaction of the charges, the time having been reduced from forty to twenty minutes for a heat. At Wednesbury, the quintal of iron melted with cold air, consumed twenty pounds of coke: with the hot air, this is reduced to thirteen pounds.

Messrs. Cosle and Perdounet (*Annale des Mines*, 11 *Série Vol.* vi. *p.* 85,) indicate that the quantity of fuel consumed in the cupolas of Birmingham, Manchester, and Newcastle, averages twenty-five per cent. of the weight of metal melted. If we compare these proportions with the quantities now given, we see that since the adoption of the hot air plan, a saving has been effected of one-half in fuel, and other expenses in the second melting of the iron.

In most cases where the air intended to sustain combustion in the cupolas, is not furnished by the apparatus attached to smelting furnaces, they are in the habit of using the flame which escapes from the top, for heating that which it consumes. I here add a succinct description of two kinds of apparatus placed above the top for this purpose. They were constructed at the shop of Messrs. Jeffries & Patton, London.

The apparatus represented at Plate 3, figs. 19 and 20, consists of a series of pipes, *a a' a''*, disposed horizontally over the mouth, and communicating by elbow pipes, with two boxes, *b* and *b*, placed upon the vertical face of the cupola; the air passing from the blast engine arrives in the pipe, *c*, enters the compartment, *d*, in the box, *b*, passes into the pipe, *c'*, and the compartment, *d'*, in the box, *b*, following the direction indicated by the arrows, it arrives in *f*, whence it is divided for distribution between the two tuyeres—all parts being made of cast iron.

The second apparatus (Plate 3, figs. 17 and 18,) is composed of a series of vertical tubes, *a*, disposed in a circle round the wall of the mouth; these pipes are three inches diameter in the clear, communicating at the extremities with two rings, A and A, placed one on the top of the cupola, and the other above the vertical tubes, *a*. One large cylinder of sheet iron, envelopes on the outside, the whole of the tubes, and obliges the flame to circulate round them. The air from the blowing machine passes into the upper ring, A, by the pipe, *c*, fig. 18. It is then divided between the vertical pipes, *a a'*, and reunites in the lower ring, A. Finally it is distributed to the tuyeres by means of two vertical tubes, *d d'*. In the upper part of the tunnel head, and above the lower ring, an opening is made by which to charge the cupola. I have not seen this last apparatus in operation, but it appears to be preferable to that described first. The air must acquire a higher temperature, and encounter less resistance in its passage.

Employment of Heated Air in Refineries and Smith's Forges.

The use of heated air has been tried in the refining of iron, and in the forges to work it.

I have not had occasion to visit works where trials have been made in blowing the refineries with hot air, but I know that at the Janon forge, near St. Stephen, the results obtained by using this plan have been but slightly favourable to its introduction; the same experience has been had near Birmingham. The want of success of this plan in refineries does not invalidate the evidences of its advantages in the smelting furnace, which has been proved in so many instances.

This difference in the results of the use of heated air in the smelting furnace and the refinery, appears to show that the air operates upon different principles in the refining of metal and fusion of the ore.

I have stated, at the commencement of this Report, that the first trial of heated air was made by Mr. Neilson, on a smiths' forge, at the Glasgow Gas Works.

The air is heated by the same fire as the forge, by means of a double cast iron box, (Plate 3., fig. 21,) which forms the bottom of the forge fire. The air arriving by the tube F, passes into the bottom, D, of the box, and returns by the tuyere, E, after having traversed the compartments, H and H'. Mr. Neilson showed the operation of this apparatus by having several bars of iron, of different sizes, forged in my presence, so that I could judge of the effect produced. Not having seen comparative experiments, it is difficult for me to form a judgment of the advantages derived. I cannot, however, conceive that the feeble temperature which the air could acquire in the apparatus adapted to this forge, could have much influence upon the economy of the operation. I had the fire cleaned out, to see the exterior disposition of the apparatus,and at the same time to appreciate the time necessary for welding. The fire was then laid on, and in four minutes after lighted coal was placed on the forge, a bar of iron, one inch square, was heated to a white heat. In taking it from the fire, this bar shot forth brilliant scintillations, and the little scoria that covered it, ran in liquid drops. The bar, plunged in water, was still, after being immersed a minute, a dark red, but hot enough to be hammered. I have not been able to determine the quantity of fuel consumed; it varies according to the size of the bars to be worked. Mr. Neilson assures me that the consumption of fuel in this forge has been reduced one-third since it has been fed by hot air.

It appears that there are many smelting forges in which they have adopted this new plan.

Trials upon Heated Air in France.

For some months, the French iron masters have been attempting to introduce the hot air plan. M. Boignes, who has contributed so much to the improvement in the iron trade, by the construction of the fine forge, *á l'Anglaise*, of Tourchambault, (Nièvre) has also made essays in the employment of heated air. Many other works, those, for example, of *Vienne*, (Isère) of *La Voulte*, (Ardéche) and of *Riouperoux*, near Grenoble, have adopted the plan.

The apparatus constructed by M. Boignes, presents, as that of the Clyde Works, (Plate 2, figs. 1 and 2,) a long development of pipes; the furnace of Torteron, (Cher) to which he has applied this plan, is worked with a mixture of coke and charcoal.

The application of heated air at this furnace has not produced results as favourable as were expected; but the nature of the metal has completely changed; the white iron has become gray, and now this furnace produces iron of a quality suitable for the most delicate castings, and enters into competition with the English metal.

Fig. 11.

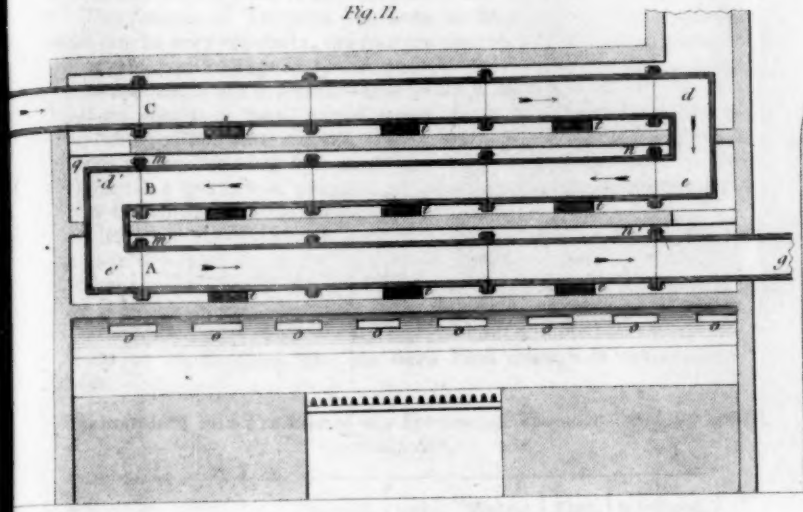


Fig. 12.

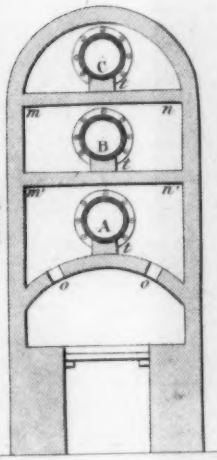


Fig. 13.

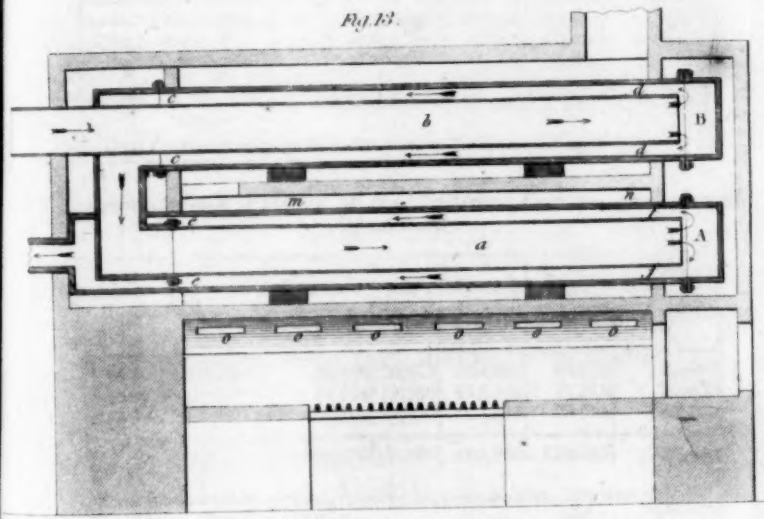


Fig. 14.

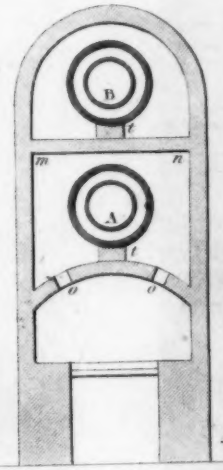


Fig. 15.

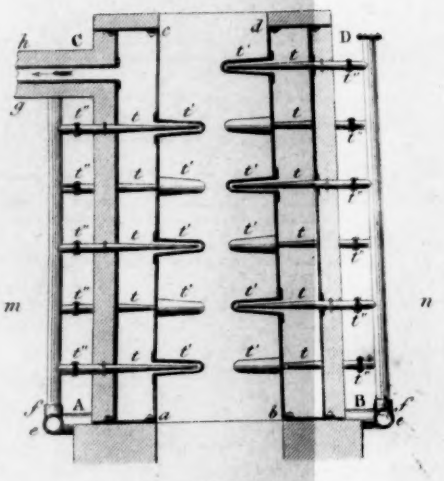


Fig. 16.

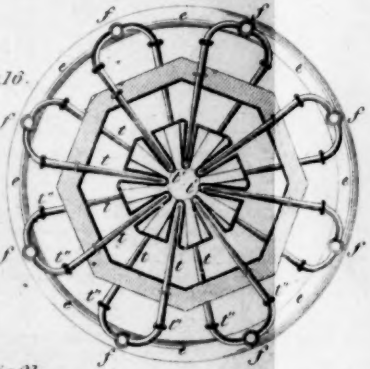


Fig. 17.

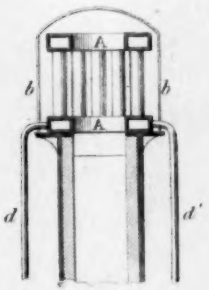


Fig. 18.

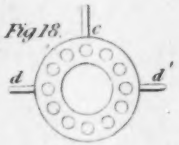
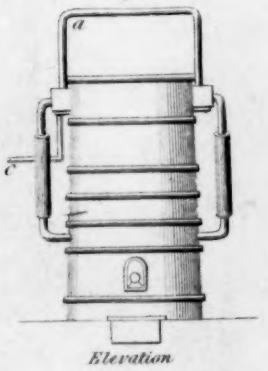
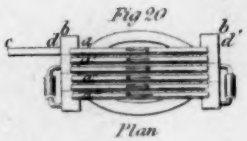


Fig. 19.



Elevation.

Fig. 20



Plan

Fig. 21.

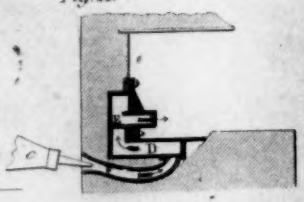
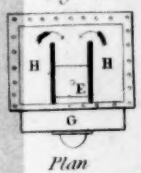
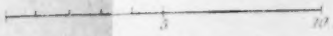


Fig. 22.



Plan



0 5 10 Feet Eng.

Engraved by J. Wagner.

When this metal is run into pigs, its grain is coarse, and the structure scaly, and very brilliant. The grain of this iron becomes much finer when cast into thin pieces, or founded a second time, and in this state it is remarkably soft under the chisel.

The furnace of Torteron has been in blast twenty-eight months, and works very regularly, the charges succeeding each other in equal intervals, and average forty-two or forty-four each twenty-four hours. Two species of ore are used—one called *mine froide*, is the true mineral *du Berry*, in small round grains, brown and slightly ochreous; the other, called *mine chaude*, is very argillaceous, being composed of grains disseminated in fine tenacious clay. The fuel used in this furnace is a mixture of charcoal, principally oak, and of coke brought from the collieries of St. Stephen.

I have not the data to determine precisely the saving effected by the use of heated air at the furnace of Torteron; but, for want of it, I compare the results obtained from two furnaces, the Torteron and the Guerche, (Cher) near each other, belonging to the same company, and the workings of which are analogous. I am indebted for these statements to M. Boignes, who has been kind enough to communicate them.

Consumption and Produce of the Furnace of Guerche, working with Cold Air.

Weeks.	Charcoal.	Coke.	Mineral.	Flux.	Iron produced.
	Kilogr'ms.	K.	K.	K.	K.
24 to 30 Nov. 1833	33,320	16,800	101,500	22,400	41,524
1 to 7 Dec. "	34,510	17,400	99,000	22,400	40,460
8 to 14 " "	33,320	16,800	93,000	22,400	38,430
	101,150	50,000	293,500	67,200	120,414
Coal for steam engine from 24 Nov. to 14 Dec. 335 hect. 95					

Consumption and Produce of the Torteron Furnace, worked with Heated Air.

Weeks.	Charcoal.	Coke.	Mineral.	Flux.	Iron produced.
	Kilogr'ms.	K.	K.	K.	K.
24 to 30 Nov. 1833	38,528	20,640	129,000	44,720	46,969
1 to 7 Dec. "	34,384	18,420	115,125	39,910	40,607
8 to 14 " "	35,504	19,020	122,675	39,625	43,307
	108,416	58,080	366,800	124,255	130,883
Coal for the steam engine, from 24 Nov. to 14 Dec. 364 hect. 69					
do. heating apparatus,				543	16

It follows from these tables, that for each ton of iron, (1000 kilogrammes) there is consumed,

	The Guerche.	*Torteron.**
Charcoal, . .	833 kilogs.	828 kilogs.
Coke, . . .	413	443
Mineral, . . .	2437	2802
Flux, . . .	558	949
Coal for the steam engine,	2.79 hectogs.	2.71 hectogs.
do. for heating apparatus,		4.15

The comparison which results from an examination of these numbers, is not favourable to the employment of heated air; but it should be stated that the operations of these furnaces are not in all respects comparable, because of the difference which exists between the materials employed. The ore used at the Guerche furnace yields forty-one per cent. of metal, while at Torteron the product is only thirty-five per cent. The quantity of flux added to the metal at Torteron is almost double that required at the other furnace. Notwithstanding these disadvantages, the daily produce of the Torteron furnace is greater than at the Guerche. If, then, instead of comparing the quantity of fuel consumed with the iron produced, we seek the relation between the ore melted and fuel, we find that the Torteron works operate with the greatest economy. In fact, in the Guerche furnace, 1000 kilogrammes of ore and flux require 419 kilogs. of fuel; while, at the other, 1000 kilogs. of the same mixture requires only 339 kilogs.

The use of heated air, then, at Torteron, presents a sufficiently marked economy; but an advantage which is quite as essential, is the improvement in the quality of the iron, which by this plan is rendered suitable for castings. This circumstance has enhanced its value at least twenty-five per cent. over the iron smelted with cold air.

Besides the furnace of which I have spoken, there is at Torteron, a cupola in which is used the apparatus for heating air, (Plate 3, figs. 19 and 20,) made in the workshop of Mr. Jeffries, of London.

I cannot state the advantages that result from the employment of heated air in this cupola, because I only know the consumption at this time. M. Boignes, who communicated these documents, shows that the new plan has produced but slight saving in fuel; but the principal advantage which results from it, is in accelerating the melting operation, the iron remaining a long time exposed to the blast.

This acceleration permits them to make many more castings in a given time.

* The blast engine at the Torteron furnace is sixteen horse power. The consumption of fuel has been augmented considerably since the introduction of heated air. This circumstance proves what we have already stated, that it requires a greater force to project the same quantity of air into the furnace when it is heated, than when cold.

Consumption of the Cupola at Torteron, worked with Heated Air, during six days.

1833	Consumption.		Product in Casting.		Consumption in Iron and Fuel to each 100 kilogs. of Casting.	
	Iron.	Coke.	Number of pieces.	Weight.	Iron.	Coke.
	Kil.	Kil.		Kil.	Kil.	Kil.
8 Dec.	2700	740	131	2460	108	30
9	3600	1070	246	3345	107	32
10	2550	710	135	2366	108	30
11	2650	740	139	2451	108	30
12	2600	720	126	2380	109	30
13	2400	680	117	2169	110	31
	16,500	4660	894	15,171	Mean 108	30

The employment of heated air, introduced into the furnace of Vienne eighteen months since, has effected a saving of nearly one-third in the fuel. M. Gueymard, in a report addressed to the Director General of Mines, &c., has stated that the consumption of coke, which was 250.87 ks. per 100 kilogrammes of iron produced with cold air, has been reduced to 146.24 ks. The expense of flux has also diminished nearly one-half; and the production, which was formerly 4,750 kils. of iron each twenty-four hours, has been increased to 5,988 kils. Since the report I have cited, Messrs. Cocq. Defourcy and Mont-marin, junior engineers of mines, have, by order of the director general, visited the Renne works. They have presented a memoir on this work, in which they give very circumstantial details in relation to the consumption of the furnace since the introduction of heated air. Their statements entirely confirm those given by M. Gueymard, and the details are worthy of record. The following is a literal extract from the memoir from which I quote:

Consumption and Produce of the Vienne Furnace, during the months of September, November, and December, 1832, and August, 1833.

Designation of month.	Coke for fusion.	Mixture and quantities of Mineral. (1)				Flux.	Coal for heating air.	Iron produced	No. of charges.
	K.				K.	K.	H.	K.	
September, 1832. Cold air till 25th	274,920	Ore of	Voulte,	145,000		65,650	—	90,869	1201
Heated air from 25th to 30th		do.	Compte,	32,012	216,712				
		do.	Bujet,	39,700					
November, 1832. Heated air	241,696	do.	Voulte,	262,112	296,512	50,612	652	143,929	1016
		do.	Bujet,	34,400					
December, 1832. Heated air	236,104	do.	Voulte,	230,850	245,375	54,562	644	122,298	1017
		do.	Bujet,	14,525					
August, 1833. Heated air	218,391	do.	Voulte,	166,974	230,211	63,237	537	108,622	1015
		do.	Bujet	63,237					

(1) They work in the Vienne furnace, a mixture of ore from Voulte, Franche Compte, and Villebois or Bujet. The mineral from Voulte is a mixture of oolitic, iron ore and carbonate of iron.
The ore of Franche Compte comes from D'Autrey, and is a mineral in grains, yielding 35 to 28 per cent.
The ore of Villebois, or Bujet, is very poor, composed of small oolitic grains, disseminated in chalk, which serves to diminish the quantity of flux required.

From these data the following table has been calculated, showing the quantities of coke, of ore, and of flux consumed at the different periods cited, to produce 100 kilogrammes of iron. The daily production of iron has also been added; and, to facilitate the comparison with the English works, the coke used has been transformed into crude coal. In this transformation we have considered the hectolitre of coal to weigh seventy-five kilogrammes, and have assumed the yield of coal to be fifty per cent. in coke.

Consumption to obtain 100 *kilogrammes of Pig Iron.*

	Ore.	Flux.	Coke for fusion.	Coal for heating air.	Total Coal.	Product of metal in 24 h'rs.	No. of charges in 24 h'rs.	Composition of charges.	
1828	K.	K.	K.	Hect.	K.	K.			
Cold air	235.00	109.28	275.00	—	550.0	3500.00	51	Coke,	200
								Mineral,	75
								Flux,	75
Sept. 1832.									
Cold air	238.45	72.24	302.50	—	905.0	3028.90	40	Coke,	228.90
								Mineral,	180.44
								Flux,	54.66
Nov. 1832.									
Hot air	206.01	35.16	167.92	0,453 or kil. 33.97	369.8	4797.60	33.90	Coke,	237.88
								Mineral,	291.84
								Flux,	49.81
Dec. 1832.									
Hot air	200.63	44.61	184.87	0,526 or kil. 39.45	409.4	3945.09	32.80	Coke,	232.15
								Mineral,	241.27
								Flux,	53.64
Aug. 1833									
Hot air	211.93	58.21	201.05	0,493 or kil. 36.47	439.1	3503.92	32.72	Coke,	215.16
								Mineral,	226.71
								Flux,	62.30

It appears from an examination of this table, that the month of November presents the most advantageous results, both as respects the quantity of iron produced and the consumption of mineral and of flux.

During this month, however, the metal was almost all white. The quantity of iron produced, must therefore be considered, rather than the quality.

During the month of August, the quantity of iron made, as well as

the consumption of material, was diminished; but the metal produced was of a superior quality.

The saving in expense resulting from the employment of heated air, has been, by comparing the products of 1828 (cold air being used) with the month of November, 1832, for each 100 kilog. of iron, 49 kilog. of mineral, 74.12 kilog. of flux, and 180.20 kilog. of coal; and the daily production of the furnace has been increased 1297.20 kilogrammes.

La Voulte Iron Works.—Since the month of September last, one of the three furnaces which compose this establishment, was worked with heated air.

The apparatus, constructed by Philip Taylor, civil engineer, consists of a horizontal pipe, 0.57 met. (22.4 inches) exterior diameter, and 43 metres (157½ feet) in length, having branches diverging to each tuyere. This pipe, which rests upon rollers, to prevent the inconvenience resulting from its expansion, and traverses the heaters placed near the tuyeres. The position of this furnace, placed only a few feet from an almost vertical escarpment, presented a great obstacle to the placing of this apparatus. Mr. Taylor has surmounted this difficulty, by constructing an arch, resting upon the escarpment, and upon the back wall of the furnace. The surface exposed to the action of the heat is 177,795 square metres,* (near 200 square yards.) The quantity of air injected through each tuyere is 500 cubic feet per minute.

Before the employment of heated air, seventy-two charges were passed through this furnace every twenty-four hours, each composed of—

230 kils. ore,	making per day		16,560 kils.
200 do. coke,	do.	do.	14,400
60 do. flux,	do.	do.	4,320

The average produce from this quantity was 7,000 kilog. of iron.

As soon as the heated air was applied to the furnace, the charges descended more slowly, and on the second day, twenty kilogs. were added to each charge. The next day, the working of the furnace being good, forty kilogs. were added to each charge. This second addition increased the rapidity with which the burthen descended, and seventy-six charges were passed in the same time. The scoria were very liquid, and bore all the marks of good working; the iron was of a crystalline structure, and a deep gray.

The two following days, the charges were again augmented forty kilogs., and Mr. Taylor, who had charge of the experiments, determined, as the iron was still too gray for puddling, to add twenty kilog. more of mineral.

* From some experiments made upon heaters of different forms, it appears that to raise the temperature of 100 cubic feet of air to 320° in each minute, requires that it shall traverse a surface of tube of one and one-third metres, heated to a low red heat.

The eighth day, seventy-six charges were passed, composed of—

350 kilog.	mineral,	making, total	26,600 kilog.
200 do.	coke,	do.	15,200
60 do.	flux,	do.	4,560

The product being raised to 11,000 kilogs. of mottled gray iron. Afterwards, the number of charges was raised to eighty-four per day, and the produce of the furnace to 14,000 kilog. of iron. The fuel employed to heat the air, was 0.25 of fine coal or slack, to 1. of iron.

According to the report of the experiments made by Mr. Taylor at the establishment of La Voulte, by the employment of hot air, the result is, that to produce 1000 kilog. of iron, the consumption of coke has been reduced from 2,057 kilog. to 1,210, including the coal used to heat the apparatus, supposing it to be transformed into coke.

This establishment presents at once, under the same roof, one furnace working with heated air, and two working with cold air, under exactly similar circumstances. The results we have indicated, therefore, can be constantly made the subject of comparison.

At *Riouperoux*, in the department of Isere, M. Gueymard has obtained analogous results. The furnace that consumed, a short time ago, 1,610 kilogs. of charcoal per ton of iron produced, has reduced its consumption to 1,270 kilogs., by raising the air to 130° R., (280° Fahr.) not including the anthracite which is used to heat the apparatus. This result is important, as it is the first example of heated air having been applied to a charcoal furnace, and dispels the doubts of those who believed that the plan could not be adapted to this kind of fuel.

At *Wurtemburg*, the hot air plan has been recently introduced into the royal foundry of Wasseralfingen, and has effected a considerable saving in fuel. The quantity of charcoal there required to obtain 100 pounds of iron, has been reduced from 185 to 113 pounds, and the daily production has been raised from 7,530 pounds to 10,500.

The apparatus employed in this foundry to heat the air, is placed over the tunnel head, and no other fuel is found necessary.

(*To be continued.*)

Imitation of Bronze by Painting on Iron.

The vast quantity of cast-iron employed at the present time for common purposes, and the still increasing demand for them, have induced superintendents of the provincial forges to inquire of us the method of painting the metal, to give it that appearance of bronze observed in many utensils furnished by the ironmongers of Paris to their customers. The process is simple, and provincial manufacturers will find their interest in adopting it, by the advantageous sale of their merchandise.

When articles to be exposed to the air are to be bronzed, they are, in the first place, covered with one or two coats of yellow oil-paint, (ochre;) when these are dry, one or two coats of deep green oil-

paint are spread very evenly on them; as soon as the last paint is almost dry, but yet sticks, the raised surfaces are rubbed with a rough brush, filled with powdered yellow ochre, or stil de grain.* The powder adheres to the surfaces touched, and gives them a bronze tint; to increase the resemblance to the real article, the depressions and re-entering angles of ornaments, are retouched with verdigris, ground in oil; when completely dry, the articles are varnished.

More delicate articles, intended for the interior of houses, which should, of course, present a more perfect finish, are painted in the following manner. The yellow colour, which is to be used for the first coat, is ground quickly with spirits of turpentine, and added to copal varnish; this mixture is laid on with a flat badger brush; when the paint is dry, it is polished with pulverized pumice; the yellow and blue paints, in proportions proper to give the desired green tint, are ground in the same way, and laid on in successive layers, each coat being allowed to dry thoroughly; when the last coat is nearly dry, but yet sticks a little, the parts which are to be bright are rubbed, more or less lightly, with a fine martin or badger brush, which has been filled with dry bronze powder, (a kind of pulverized copper, sold in packages in the paint stores.) The bronze adheres, the paint is allowed to dry, and the article is varnished with good copal varnish.

When articles are to be prepared very carefully, each coat of paint is dried by a furnace or stove heat, and nicely polished when dry. The process given at length above, is the one employed when the object is to work economically; nothing is easier than the preparation of ornaments of this kind.

It is well understood that pulverized copper may be used in bronzing articles to be exposed to the air, when greater brilliancy is required: it is sometimes necessary to give the painting two coats of thick varnish. [*Jour. des Conn. Usuel. et Prat.*

Extract from the Report of Benjamin Wright, Esq., *Civil Engineer, who was appointed by the Governor to survey the route of the New York and Erie Rail-road.*

To John A. Dix, Esquire,

Secretary of State:

Sir,—His Excellency, the Governor, having been pleased to appoint me to execute the survey, and make an estimate of the expense, of a rail-road from "*at or near the city of New York, to Lake Erie,*" under the act of May 6th, 1834, which said act requires me to file the report, maps, profiles, and estimates, in the office of the Secretary of State:—

In conformity to said act, I now present my report, maps, profiles,

* A yellow coloured powder, made by mixing together ceruse, alum, and Avignon berry, the fruit of the buck-thorn.—*Trans.*

&c., to be filed in your office, as the law directs, and beg leave hereby

TO REPORT:

That in undertaking the important and responsible duty of surveying the route of a railway communication from the Hudson river, near the city of New York, to Lake Erie, I deem it essential to keep in view the great public objects sought to be attained by the proposed work. It was obvious that the road was to be constructed, not only for the accommodation of the inhabitants of the district immediately adjacent to the route, but also in order to furnish the means of a regular, rapid, and uninterrupted intercourse, at nearly all seasons of the year, between the city of New York, and the extensive and populous communities upon the western lakes and waters.

The vast and acknowledged benefits which had been experienced throughout a great part of the state, and especially by its commercial emporium, from the construction of the Erie Canal, as well in the increase of population and wealth, as in the progress of agriculture and trade, the augmented value of lands, and the rapid and unexampled growth and creation of cities, towns, and villages, along the route, had plainly proved that a thoroughfare running through the southern tier of counties, and properly suited to their topographical character, could not fail to impart similar advantages to that important and valuable section of country, while the pressing necessity of establishing a channel of communication within this state, which should be open during nearly, or quite, the whole of the winter months, and thereby remedy the evils occasioned by its high northern latitude, had not only been felt sensibly by the inhabitants of the metropolis, but had excited public attention throughout a great portion of the fertile and extensive regions upon the upper lakes, and in the valley of the Mississippi.

The long line of counties in our own state, through which the road would pass, favoured as they are with a healthful climate, and an enterprising population, abounding in natural resources, which the proposed work could not fail to develope, also possessed an additional importance in their peculiar topography, being intersected in numerous directions by important streams, leading into that section of the country from other parts of the state, and thereby furnishing striking facilities for connecting the proposed road with lateral branches, capable of accommodating large masses of our population.

Keeping, therefore, steadily in mind, these general considerations, I deemed it an incumbent duty, in selecting the line of location for the proposed road, to obtain a route which, as far as should be practicable, might combine—

1st. Reasonable economy in its construction.

2d. Rapidity and regularity of communication for passengers, light merchandise of value, and the public mail.

3d. Cheapness of transportation for bulky commodities.

4th. Facilities of connection with lateral branches.

5th. The general accommodation of the inhabitants, and the development of the resources, of the country along the route.

And I considered it also necessary to take into view, not only the present, but the prospective, advantages of the route, and to arrange the graduation of the whole work, in reference to such further additions and improvements as might hereafter become necessary, in order to accommodate a great increase of trade and transportation.

Being guided by these general outlines, I commenced the survey of the route on the 23d of May last, under the appointment which I received from his Excellency, the Governor, on the 21st of that month.

It is possible, and I may say probable, that the shortness of time allowed for the completion of so long a line of survey, in some instances not noticed by me, may have prevented our ascertaining the very best and cheapest route, of which some portions of the country may have been capable; but I have become perfectly satisfied, from the lines already run, and minutely measured, that a feasible route has been obtained, free from formidable difficulties, and capable of being completed with economy and despatch.

The great object of securing rapidity and regularity of communication between the city of New York and the lake, being one of paramount importance, I have studiously sought to avoid the use of stationary steam power on inclined planes, as being productive of delay, danger, expense, and difficulty; and in this respect, have been so successful, that, with the exception of one single plane, near Lake Erie, I have brought the whole line within the power of locomotive engines, drawing passenger cars, light merchandize, and the public mail.

The steepest acclivity encountered on the whole line, with the exception before mentioned, will be only one hundred feet per mile; and having been furnished with satisfactory evidence that, by recent improvements in the locomotive steam engines, on the Baltimore and Ohio Rail-road, they have been enabled to ascend an acclivity of 176 feet to the mile, drawing between five and ten tons weight, I rely upon that fact in stating that locomotive steam engines may be advantageously used on the whole of the proposed route, from the Hudson river to the head of the plane near Lake Erie; that they will be able to pass its steepest grades, drawing at least seventy or eighty passengers, with their baggage; while upon at least nine-tenths of the whole route, they will be able to propel very great burthens, at a great rate of speed.

In order, however, to obtain these easy grades of acclivity, I have been compelled to pursue, by a serpentine line, the valleys of streams, and thereby to lengthen very considerably the linear extent of the route.

The general face of the country is undulating, and marked by bold and prominent features; but, nevertheless, it is intersected by numerous rivers and their branches, which have a gentle descent, and fortunately pursue the general direction necessary for the route, in much of the distance.

It is this all-important and cardinal feature in the topography of the country, and the facilities which the valleys of those streams thus present, for obtaining gentle ascents and descents, and moderate graduation, which will explain the reason why I have been able to find a cheap and easy route, without the aid of stationary steam power, through portions of the state which, to the eye of the passing traveller, crossing as he does the numerous hills which are traversed by the ordinary stage roads, would seem to present insuperable obstacles to the accomplishment of the proposed work.

An examination of the plans and profiles returned with this report, will show that the route, instead of passing directly *over*, goes *around* the hills; and that it has not been necessary to surmount any considerable acclivities, except in three or four instances, in which the line crosses the natural boundaries of the great valleys into which the route is topographically divided.

It is true, that the departure from a straight line thus occasioned by following the winding of the water courses, has considerably lengthened the whole route between New York and Lake Erie; but when it is considered that great rapidity of transportation, and cheapness of construction, have been thereby secured, and a greater portion of country accommodated; that the conformation of the country wholly forbade the adoption of any other route, more direct, without enormous expense; and that the circuity of route will be comparatively less than that of the Pennsylvania Canals, its deviation from a direct line will not be regarded as a formidable obstacle, or objection.

The natural boundaries of the valleys which are pursued by the route, will serve to subdivide it into six grand divisions, to wit:

The *First, or Hudson River Division*, extending 73½ miles from a point in the Hudson river, twenty-four miles north of the City Hall of New York, to a point in the Deer Park Gap, of the Shawangunk Mountain, dividing the waters flowing into the Hudson, from those flowing into the Delaware.

The *Second, or Delaware Division*, extending from the point last mentioned, through the valley of the Delaware and its tributaries, 115 miles, to a summit, twelve miles north-west of the village of Deposit, in Delaware county, dividing the waters of the Delaware from those of the Susquehanna.

The *Third, or Susquehanna Division*, extending from the point last mentioned, through the valley of the Susquehanna and its tributaries, 163½ miles, to a summit, 13 miles south-west of the village of Hornellsville, in the county of Steuben, dividing the waters of the Susquehanna from those of the Genesee.

The *Fourth, or Genesee Division*, extending from the point last mentioned, across the valley of the Genesee, 37 miles, to a summit three miles east of the village of Cuba, in Allegany county.

The *Fifth, or Allegany Division*, extending along the valley of the Allegany and its tributaries, 83 miles, to the head of the inclined plane, distant four or five miles from Lake Erie, on a straight line.

The *Sixth, or Lake Erie Division*, embracing the short and rapid descent to the lake, including the inclined plane and the two branches, one to Portland, nine miles, and one to Dunkirk, eight and a half miles.

It will be perceived by an inspection of the profiles, that the only points where the rates of ascent exceed sixty feet per mile, will be found on the summits above specified, as forming the boundaries of the six grand divisions of the route. The acclivities in passing these summits are respectively as follow:

One grade of one hundred feet to the mile, in passing from the Hudson River Division, down the west side of the Shawangunk mountain, into the Delaware Division:

One of seventy feet, and one of sixty-five feet, to the mile, in passing from the Delaware Division to the Susquehanna Division:

One of seventy feet, and one of sixty-one feet, to the mile, in crossing the ridge between the Susquehanna and its tributary, the Chenango river:

And one of seventy-two feet to the mile, in passing from the Susquehanna Division to the Genesee Division.

I have no doubt that all these ascents and descents above specified may readily be surmounted by locomotive engines drawing passenger cars, light merchandise, and the mail. But in order to aid the passage of burthen cars heavily loaded, it will be necessary to station at the several points above specified, either auxiliary locomotive engines, as is practised on the Liverpool and Manchester Rail-road, or an increase of animal power, as is used in passing the Parr ridge, on the Baltimore and Ohio road. That this can be effected without any material interruption or inconvenience, will be obvious, when it is recollected that the western slope of the Parr ridge, on the last mentioned road, has an ascent of no less than 253 feet to the mile; an acclivity nearly three times as great as the steepest grade on the proposed route; but that it is nevertheless surmounted at all times by burthen cars heavily loaded, aided only by an increase of animal power.

It will also be borne in mind, that at least three-fourths of the heavy tonnage passing on this road will descend eastward, towards tide water. The elevation of the head of the inclined plane near Lake Erie, being 1303 feet above the Hudson river, the products of the western country, passing eastward, will necessarily descend 1303 feet more than they will ascend, and their passage will consequently be aided to that extent by their own gravitation.

It is, however, by no means impossible that, in the course of twenty years, the great increase of the population and agricultural products of the interior, and the necessity of expediting their passage to market, may render it expedient and economical to adopt additional tracks, with a compound moving power, and grades reduced in all cases to thirty feet per mile, with stationary engines, operating on inclined planes, and located at intermediate points along the road. In that event, the entire change might be effected along the whole line, without altering more than thirty or forty miles of the road.

And although I do not believe that this change will ever be made, or become necessary, except in the event of so great an increase of trade as to make steady, uniform power the best, in which case I believe that stationary power, applied on the present grades, would be found the best, and used as Messrs. Walker and Rastrick proposed on the Liverpool and Manchester road, as *reciprocating power*, I have thought it proper to state how far it would affect the graduation of the road to substitute planes and stationary power, and grades in other places of thirty feet per mile.

The change of plan last mentioned would only apply to burthen cars, in any event, as passenger cars would be liable to less danger, interruption, and delay, by using the locomotives, or extra animal power, to surmount the dividing ridges.

In making the survey and location, I have had lines of exploration made on various parts of the route, in two or three different directions, and more particularly near the Hudson river, where four different routes to several landings were examined, and are all represented on the maps and profiles herewith returned; and if the funds had held out to accomplish some further examinations in Rockland county, and time had permitted, I should have pursued still another line from a point on map No. 1, marked Z, and followed on the northern and eastwardly side of the Hackensack river, in the direction of the dotted line, so as to join the line which runs to the river at Tappan. Such a line ought to be explored before the final location of the road through Rockland county.

Another part of the line in Orange county ought also to be noticed, as deserving of further examination, which is exhibited in maps Nos. 3 and 4. A strong and ardent desire to accommodate, by passing in the immediate vicinity of so important a town as Goshen, and former examinations for a rail-road having produced impressions favourable to that route, I had supposed it would prove the best ground, and therefore spent our labours upon it; and it was not until it was too late, that we observed the formation of the country from near Chester, through by Florida, and the practicability of passing the Wall Kill near Pellet's Island, and joining the present line some six or seven miles west of Wall Kill, that we supposed we could change from the route near Goshen. This route requires an instrumental examination; but unless it prove greatly superior to that by Goshen, as now returned, the accommodation of so important a town ought to give it the preference. The routes between the Wall Kill and Shawangunk mountain are exhibited on the map and profiles, and a final location on this part is intimately connected with the suggestion about the Florida route.

It has been proposed to cut upon the top of the Deer Park Gap, (which is a deep depression of the Shawangunk mountain,) about fifty feet at the highest point. This is done in order to reduce the grade upon each side, and particularly on the west side, to one hundred feet per mile. The east side can be easily reduced to a grade of sixty feet, for a short distance, and then much less.

I have looked at this point, and given it considerable thought, to

determine what ought to be the present plan, in reference to future improvements, when the great increase of business on this road will demand every facility that the nature of the country will permit; and it has brought my mind to the conclusion, that before the lapse of twenty years after the completion of the road, a tunnel will be driven through the mountain, of about three-quarters of a mile in length, whereby its elevation would be so reduced, as to permit a grade of probably seventy-five to eighty feet, on the west side, and about thirty on the east. As the acclivity of one hundred feet to the mile, on the west side of the mountain, is the steepest grade encountered on the road, it has also appeared to me to be well worthy of observation, how far this ascent could be relieved by the adoption of an inclined plane with a stationary engine, believing that, if it is admissible on any intermediate point on the route, it might be employed at this point, for the relief of the burthen cars, to great advantage. The idea of the tunnel, and the stationary engine, will, however, be matters of subsequent inquiry, at some future time, and are now referred to, only as parts of an ultimate plan, proper to be borne in mind, in the permanent location of the route.

The line, as located, then follows from the foot of Shawangunk mountain, by a high embankment across the valley of Basher's hill, and then crosses the Delaware and Hudson canal without difficulty, and soon enters the valley of the Neversink river, which it follows to the mouth of a branch of this river, called the Sheldrake, and up that to its source; thence crossing the heads of the several branches of the Mongaup, it reaches the head of the Callicoon, (a branch of the Delaware,) which it follows to its junction with the latter river.

An examination of the ground plans will show that a route has also been surveyed down the Popackton, or eastern branch of the Delaware; and there are also exhibited and marked, several other routes through Sullivan county, which have been examined, and regular surveys carried over them, and profiles made of some.

The route passing near Monticello, which is the county town of Sullivan county, would on that account deserve a preference, if the facilities and advantages are nearly equal as to other points, such as grade and cheapness of construction; and although our surveys, as we made them, did not show as favourable a line by Monticello as by the other route, I think a further and more critical examination should be made through this district of country, to find a more favourable route than we have yet seen; and should this be the case, we should, I think, shorten the route some miles, and obtain the advantages of carrying it through a more populous and settled country.

[TO BE CONTINUED.]

¶ *Sulphuric Acid as a Prophylactic against Lead Colic.*

Some time ago, M. Gendren proposed sulphuric acid lemonade as a prophylactic against, as well as remedy for, lead colic, (see this

journal for May, 1832, p. 241.) M. G. has recently communicated to the Academy of Sciences, some additional interesting information on this subject. He states that M. Rouard, director of a manufactory of white lead, caused all his workmen to take the sulphuric acid lemonade, and from that moment lead colic ceased to occur among the men in the establishment. During two months, only four workmen were slightly affected with lead colic, and this exception is explained by circumstances peculiar to these workmen. But, he adds, that at the same time that these results have confirmed the utility of the measure, as regards colic, six of the workmen were attacked with symptoms hitherto regarded as the effects of lead colic, as cramps, muscular debility, and nervous epileptic symptoms. These symptoms, M. Gendren ascribes to a layer of oxide and carbonate of lead, combined with the epidermis. This observation he considers as accounting for many symptoms hitherto difficult of explanation, and points out the origin of the relapses and symptoms which so often supervene after the cure of colics in workmen habitually exposed to the powerful action of the causes of the disease. He further adds, that whether the sulphuric acid be used as a prophylactic or remedy, it must be employed externally, as well as internally. Conformably to this indication, the workmen in the establishment of M. Rouard, at the same time that they take the sulphuric acid lemonade as drink, use lotions of the same to the surface of their bodies.—*American Journal of the Medical Sciences, Feb. 7*, 1835.

On a Steam Engine for Pumping Water. By W. L. Wharton.

In this engine, the steam is admitted from the boiler upon a deep float, occupying the top of a column of water contained in a metallic cylinder, placed in the flue of the boiler fire. The lower part of the column of water is connected by pipes to the under side of a piston, moving water tight in a much smaller cylinder, fixed immediately above the pumps of any mine, to the rods of which is affixed the piston rod. By this arrangement, the steam always acts upon a heated surface, and its power is applied to the pump rods without the intervention of a main beam, parallel motion, &c., and, consequently, without any expense for frame-work, and buildings requisite for their support, in other engines. The friction of this engine, moreover, is very trifling, a stratum of oil being introduced both above and below the piston. A rod, or wire, is attached to the float, and passing through a stuffing box in the top of the large cylinder, works the hand gear at the proper periods after the admission and escape of the steam, and consequent depression and elevation of the water and float, within that cylinder. A condensing apparatus may be added, by which the atmosphere may be rendered available, in addition to the weight of the pump rods, to force down the piston in the small cylinder, and, consequently, the water and float, to the top of the large cylinder, after each stroke of the engine.

[*Rep. Brit. Assoc.*

¶ *The Mariners' Compass.*

The mariners' compass is generally stated to have been invented by one Flavio Gioia, a native of Amalfi, in 1302, or 1303; but, from a letter on the subject, addressed to Baron H. A. Humboldt, by Mr. J. Klaproth, reviewed in the Athenæum of Saturday last, (No. 369,) it appears very clearly that the magnet's polarity was popularly known in Europe at least a century earlier, and in China as far back as authentic history reaches. "A remarkable proof," says the reviewer, "of the Chinese claims to this invention, is to be found in the history of the *magnetic chariots*, whose origin is lost in the obscurity of the mythological ages." * * A (human) "figure, in front of the chariot, was made of some light material; it was fixed upon a pivot, and its finger invariably pointed to the south, which was the kibleh, or sacred point, of the Chinese, to which they always turned when performing their devotions. It is intimated, rather obscurely, that these magnetic chariots were first invented for a religious purpose, namely, to enable the devout to discover their *kibleh*, when the sun and stars were obscured by clouds—a purpose for which the compass is frequently applied in the present day by Mohammedan nations; but there are very full descriptions of the use made of these chariots in directing the march of armies, and guiding ambassadors. * * As our readers have probably anticipated, a magnetised bar passes through the arm of the figure, and the only variety of ingenuity displayed by the architects, was in balancing the figure upon its pivot. The antiquity of these magnetic chariots is established incontrovertibly; the step from them to the compass is so very easy, that we may safely assert that the one must have led immediately to the other." [*Lond. Mech. Mag.*

List of American Patents which issued in March, 1835.

		March
96.	*Oil bush, &c.*—Jesse Kinman, Clinton, Penn.	2
97.	*Flour packing machine.*—John Kinman, Hartley, Penn.	2
98.	*Plough.*—Joseph Tinkler, Warwick, Penn.	2
99.	*Stones, raising.*—John C. Blauvelt, Newton, Conn.	2
100.	*Propelling machine.*—Luke M. Edwards, Trenton, Tenn.	2
101.	*Wheeled carriages.*—Samuel Chapman, jr., Windsor, Mass.	2
102.	*Casting chilled rollers.*—James Harley, Pittsburg, Penn.	3
103.	*Cook stove.*—Joel Rathbone, Albany, New York,	6
104.	*Horse hame collar.*—Timothy Deming, East Hartford, Conn.	6
105.	*Trip hammer.*—Heman Redfield, Grafton, Mass.	6
106.	*Winnowing machine.*—Truman B. Browne, Locke, N. Y.	6
107.	*Seaming tin plate.*—James Redheffer, Bridgetown, New Jersey,	6
108.	*Catching fish.*—Charles Fowler, and E. R. Hanks, Hartford, Conn.	6
109.	*Brushes for colours.*—George M. Morris, city of Philadelphia,	6
110.	*Saw, using.*—Anson Field, Jerico, Vermont,	6
111.	*Thrashing machine.*—Thomas D. Burrall, Geneva, New York,	6
112.	*Mariners' Compass.*—Jonathan Ball, Buffaloe, New York,	6
113.	*Fishing Boat.*—John Donn, Washington, D. C.	6

March

114. *Stove.*—George J. Payne, Erie, New York, 6
115. *Sausage cutting machine.*—P. Fahnestock, and J. Mann, jr., Quincy, Penn. 11
116. *Printing press, improved.*—John C. Rives, Washington, D. C. 11
117. *Grates.*—Barnabus Pike, city of New York, 11
118. *Tailors' shears.*—J. Andrews, assignee of R. Heinisch, city of New York, ... 11
119. *Water wheel.*—Robert Eastman, Concord, New Hampshire, 11
120. *Water closet.*—James Stone, city of New York, 11
121. *Horse hames.*—Timothy Taylor, Loudon county, Virginia, 11
122. *Mortar machine, &c.*—Samuel Whitman, Danville, Ill. 11
123. *Churn.*—Benjamin Randall, N. Pownal, Maine, 11
124. *Horse power.*—William E. Arnold, Chatham, Conn. 13
125. *Steam wheel.*—William Wilson, Henderson county, Tenn. 13
126. *Hulling, shelling, and thrashing, machine.*—Jesse S. Dick, Genessee county, New York, ... 13
127. *Boats for rivers and canals.*—Anthony Plantou, Philadelphia, 18
128. *Carriage springs, connecting.*—Amos Davis, Easton, Maryland, 18
129. *Grain mill.*—Frederick Smith, Evans, New York, 18
130. *Garlic and smut machine.*—T. J. Sands, and B. Hendig, Washington, Penn. 18
131. *Composition for white paint.*—Forrest Shepherd, Fredericksburg, Va. 18
132. *Coach panels of metal.*—Ebenezer A. Lester, Boston, Mass. 18
133. *Ointment.*—William W. Gears, Richmond, Va. 18
134. *Wrought nail machine.*—Samuel G. Reynolds, Providence, R. Island, 18
135. *Mills, metaltic, dressing.*—Samuel G. Reynolds, Providence, R. I. 20
136. *Thrashing machine.*—David G. M'Coy, Dublin, Maryland, 20
137. *Cotton and hay press.*—Samuel T. Baker, W. Gorham, Maine, 20
138. *Power loom.*—David Whitman, Windham, Conn. 20
139. *Rail-road car wheels.*—John Baker, Lancaster, Penn. 20
140. *Franklin cook stove.*—Isaac M'Nary, Stafford, Conn. 24
141. *Washing machine.*—Stephen A. M'George, Alexander, New York, 24
142. *Steam engine.*—John Murphy, Philadelphia, Penn. 24
143. *Steam engine.*—John Sheldon, New Haven, Conn. 24
144. *Grinding and polishing stone.*—Peter Cooper, city of New York, 24
145. *Steam power and boiler.*—Benj. B. Gates, Ontwa, Michigan, 24
146. *Plough.*—Nathaniel Baker, Penn township, Michigan, 24
147. *Furnace stove.*—Henry Hubbard, Berlin, Connecticut, 25
148. *Rail-road car.*—John Withers, Bart township, Penn. 25
149. *Rail-road car.*—James Herron, Richmond, Virginia, 25
150. *Tobacco, chewing*, manufacturing.—Edward Chassaing, city of Baltimore, ... 25
151. *Blinds for doors and windows.*—Seril Steere, Gloucester, R. I. 25
152. *Pendulum power machine.*—Abraham Wade, Eagletown, New York, 25
153. *Leather finisher.*—Cushman Bassett, Boston, Mass. 25
154. *Saw mill dog.*—Martin Rich, Caroline, New York, 25
155. *Plough.*—William Hess, Lower Saucon, Penn. 27
156. *Hair, extracting.*—Samuel G. Ladd, assignee of S. Graham, Farmington, Maine, ... 27
157. *Saw mill.*—N. and P. Crosby, Pomfret, New York, 27
158. *Washing machine.*—E. Whitman, jr., assignee of E. Whitman, Winthrop, Maine, ... 27
159. *Churns and cradles, propelling.*—Ezra Winthrop, jr., Winthrop, Me. 27
160. *Inking machine.*—S. Fairlamb, and J. L. Gilpin, city of New York, 27
161. *Sad iron.*—William Wilson, Greenfield, Mass. 27
162. *Saw mill dog.*—Martin Rich, Caroline, New York, 27

CELESTIAL PHENOMENA, FOR JUNE, 1835.

Calculated by S. C. Walker.

Day.	H'r.	Min.				
2	8	32	N. App. ☽ and ♑ Leonis,	,3,4,	☽ South	1′.6
6	7	23	Im. ♄ Virginis,	,6,	N. 12°	V. 3°
6	8	20	Em.		274°	274°
7	5	19	☿ ♂ ♑ Geminorum,	,3,	☿ North	18″
11	16	20	Im. ♂ Sagittarii,	,3,	156°	189°
11	16	57	Em.		230°	267°

Meteorological Observations for February, 1835.

Moon.	Days.	Therm. Sun rise.	Therm. 2 P. M.	Barometer. Sun rise.	Barometer. 2 P. M.	Wind. Direction.	Wind. Force.	Water fallen in rain.	State of the weather and Remarks.
				Inches.	Inches.			Inches.	
☾	1	27°	31°	29.46	29.50	W.	Moderate.		Flying clouds.
	2	20	23	.75	.90	do.	do.		Clear day.
	3	16	35	30.10	30.15	NW. NE	do.		Cloudy—lightly cloudy.
	4	16	17	29.96	29.95	NE. NW.	Brisk.		Clear—lightly cloudy.
	5	12	23	.95	.95	NW.	Moderate.		Cloudy—flying clouds.
	6	21	31	.84	.80	SE. S.	Blustering	0.17	Cloudy—snow.
	7	12	13	.67	.73	W.	do.		Clear day.
	8	1	7	.75	.85	W.	do.		Lightly cloudy.
☽	9	1	15	30.10	30.20	W.	Moderate.		Clear day.
	10	4	18	.10	.10	W.	do.		Clear day.
	11	10	30	29.90	29.75	SW.	do.		Lightly cloudy—cloudy.
	12	18	26	.80	.86	NW.	do.		Clear day.
	13	22	41	.75	.80	SW.	Blustering		Lightly cloudy.
☉	14	34	32	.94	30.15	W. NW.	Moderate.		Cloudy day.
	15	18	22	.90	29.80	W.	do.		Cloudy day.
	16	29	29	30.10	30.15	SE. NE.	do.		Sleet—rain.
	17	30	31	29.94	29.85	NE.	Calm	1.30	Rainy day.
	18	33	41	.66	.70	W.	do.		Cloudy—flying clouds.
	19	34	39	.83	.90	W.	do.		Lightly cloudy—flying clouds.
	20	29	44	30.20	30.35	W.	do.		Clear—flying clouds.
	21	27	44	.30	.05	SW.	do.		Cloudy day.
	22	40	54	29.85	29.80	SW.	do.		Cloudy day.
☽	23	37	34	30.06	30.16	NE.	do.	0.37	Cloudy—snow.
	24	39	40	.20	.25	NE.	do.		Cloudy—lightly cloudy.
	25	31	40	29.95	29.96	E.	do.		Cloudy day.
	26	30	30	30.00	30.00	W.	do.		Cloudy—lightly cloudy.
	27	16	32	29.90	29.80	NNE.	do.	0.20	Snow—cloudy.
	28	5	20	.86	.90	W.	do.		Clear—lightly cloudy.
	Mean	21.21	29.36	29.92	29.94			2.04	

Thermometer.		Barometer.
Maximum height during the month,	54. on 22d,	30.35 on 20th.
Minimum do.	—3. on 8th,	29.46 on 1st.
Mean do.	25.28	29.93